Ontario

Ministry of
Northern Development
and Mines

Ontario Geological Survey
Open File Report 5587

Geology of Abotossaway, Corbiere, Leclaire and Musquash Townships and Part of Dunphy Township

1993

102-06841/

Ministry of
Northern Development
and Mines
Ontario

ONTARIO GEOLOGICAL SURVEY

Open File Report 5587

Geology of Abotossaway, Corbiere, Leclaire and Musquash Townships and Part of Dunphy Township

By

R. P. Sage

1993

Parts of this publication may be quoted if credit is given. It is recommended that reference to this publication be made in the following form:

Sage, R. P. 1993. Geology of Abotossaway, Corbiere, Leclaire and Musquash townships and part of Dunphy Township; Ontario Geological Survey, Open File Report 5587, 308p.

© Queen's Printer for Ontario, 1993

Ontario Geological Survey

OPEN FILE REPORT

Open File Reports are made available to the public subject to the following conditions:

This report is unedited. Discrepancies may occur for which the Ontario Geological Survey does not assume liability. Recommendations and statements of opinions expressed are those of the author or authors and are not to be construed as statements of government policy.

This Open File Report is available for viewing at the following locations:

Mines Library
Level A3, 933 Ramsey Lake Road
Sudbury, Ontario P3E 6B5

Mines and Minerals Information Centre (MMIC)
Rm. M2-17, Macdonald Block
900 Bay St.
Toronto, Ontario M7A 1C3

The office of the Resident Geologist whose
district includes the area covered by this report.

Copies of this report may be obtained at the user's expense from:

OGS On-Demand Publications
Level B4, 933 Ramsey Lake Road
Sudbury, Ontario P3E 6B5
Tel. (705)670-5691 Collect calls accepted.

Handwritten notes and sketches may be made from this report. Check with MMIC, the Mines Library or the Resident Geologist's office whether there is a copy of this report that may be borrowed. A copy of this report is available for Inter-Library loan.

This report is available for viewing at the following Resident Geologists' offices:

Wawa, Box 530, Helen Mine Rd., Wawa P0S 1K0

The right to reproduce this report is reserved by the Ontario Ministry of Northern Development and Mines. Permission for other reproductions must be obtained in writing from the Director, Ontario Geological Survey - Geoscience Branch.

Table of Contents

Abstract....xxxiii
Introduction....1
Location and Access....1
Acknowledgements....2
Physiography....3
Field Procedures....3
Previous Work....4
General Geology....4
  Archean....6
    External Granitic Rocks (Map Unit 1)....6
        North Contact....6
    Intermediate to Mafic Metavolcanic Rocks (Map Unit 2)....8
    Intermediate to Felsic Metavolcanic Rocks (Map Unit 3)....13
          Intermediate to Felsic Metavolcanics of Cycle One....13
          Intermediate to Felsic Metavolcanics of Cycle Two....17
    Metasedimentary Rocks (Map Unit 4)....21
        Ferruginous Dolomite....28
    Iron Formation (Map Unit 5)....29
    Mafic Intrusive Rocks (Map Unit 6)....33
    Intermediate to Felsic Intrusive Rocks (Map Unit 7)....38
        Hawk Lake Granitic Complex....39
        Quartz-Feldspar Porphyry of the Hawk Lake Granite....40
        Gutcher Lake Stock....41
        Quartz, Feldspar and Feldspar Porphyry....45
        Hypabyssal Intrusions....46
        Lund Lake Stock....50
        Troupe Lake Stock....53
        Minor Intermediate to Felsic Intrusions....54
Proterozoic....55
    Diabase Dikes, Lamprophyres, and Miscellaneous Dike Rocks (Map Unit 12)....55
        Diabase Dikes....55

        Lamprophyres

        Syenite Dike....57
Phanerozoic....58
    Cenozoic....58
        Pleistocene and Recent....58
    Metamorphism and Alteration....59
        Supracrustal-External Granitic Contact....59
        Greenschist Regional Metamorphism....59
        Gutcher Lake Stock....62
        Gutcher Lake Stock - Hornfels....62
        Troupe Lake Stock - Contact Aureole....64
        Magpie - Alice Iron Ranges....65
        Diabase Dike - Contact Metamorphism....65

        Intermediate to Felsic Metavolcanics with Chloritoid.......66
        Intermediate to Mafic Metavolcanics with Chloritoid........68
        Mafic Intrusions With Chloritoid...........................70
        Tourmaline-bearing Intermediate to Mafic Metavolcanics.....70
        Altered Intermediate to Felsic Metavolcanics -
        Magpie Mine..73
    Structural Geology...75
        Strike-Slip Faulting.......................................76
            North Contact Strike-Slip Faulting.....................77
            North Middleton Lake Strike-Slip Fault.................77
            Mall Lake - Middleton Lake Strike-Slip Fault...........77
            Perry, Selkirk, Doherty Lakes Strike Slip Fault........78
            Rand No.2 Strike Slip Fault............................78
            Mildred Lake Fault.....................................78
            Magpie River Fault.....................................79
            Evans Creek Strike Slip Fault..........................79
            Iris Strike Slip Faults................................80
            Summary..80
        Transverse Faults..81
            McVeigh Creek Fault....................................82
            Rand Fault...84
            Alden Lake Transverse Fault............................84
            Marsden Transverse Fault...............................84
            Goetz Lake Transverse Fault............................85
            Bauldry Lake Transverse Fault..........................86
            Josephine Transverse Fault.............................86
            Mildred Lake Fault.....................................87
            Centre Anticline Axial Plane Fault.....................87
        Folding..87
            Centre Anticline.......................................88
            Alden Lake Anticline...................................88
            North Range Syncline...................................89
            Kabenung-Josephine Cross Syncline......................89
            Sheldon Lake Syncline..................................89
        Structural Geology - Synthesis.............................90
        Petrology..91
        Stratigraphy...93
        Geophysics...97
        Economic Geology...97
            Base Metal Mineralization..............................98
            Iron Deposits..99
            Gold Mineralization...................................100
            Gutcher Lake Stock....................................102
            Recommendations to Prospectors........................106

References..108

Tables

1 Geologic mapping assistants for Abotossaway, Corbiere, Leclaire, and Musquash Townships....125
2 Table of lithologic units for Abotossaway, Corbiere, Leclaire, and Musquash Townships, District of Algoma; modified after Sage (1987a)....126
3 Chemistry of chloritoid-bearing and chloritoid-free intermediate to felsic metavolcanic rocks. Chloritoid-free rock chemistry from Sage (1987a)....127
4 Chemistry of chloritoid-bearing and chloritoid-free intermediate to mafic metavolcanic rocks. Chloritoid-free rock chemistry from Sage (1987a)....128
5 Whole rock chemical analysis of intermediate to mafic metavolcanic rocks, Musquash Township (from Taal, 1986)......131
6 Microprobe analysis of tourmaline and chlorite from Musquash Township (from Taal, 1986)....132
7 Chemistry of altered volcanic breccias at the Magpie Iron Range, Leclaire Township. Fresh rock data from Sage (1987a)....133
8 Minor elements in the chloritoid-bearing rocks, Josephine Mine area, Corbiere Township....134
9 Minor elements in the chloritoid-bearing rocks, Rand No. 2 Iron Range, Abotossaway Township. Samples from drill core, Superior Acid and Iron Limited....135
10 Tabulated diamond drilling Ego Resources Limited, Abotossaway Township....137
11 Tonnage estimates on various zones on the Ego Mines Limited property (Vallance 1965a, p. 6)....138
12 Drill indicated tonnages in various zones, Ego Mines Limited (Vallance 1971, p. 16)....139
13 Tabulated gold values, Farquhar vein in excess of 0.10 ounces per ton, Golden Algoma Mines Limited (AFRO, Toronto)..140
14 Conductors identified by Manwa Exploration Services Limited for International Corona Resources Limited, Abotossaway Township. Locations approximated on accompanying compilation map (Needlands et al. 1984a)....141
15 Assay data on grab samples collected from trenches on Kozak Property near shaft. (Analysis by Mineral Research Laboratory, Ontario Geological Survey)....142
16 Tabulated diamond drill hole data for Kozak Property as on record in AFRO, Toronto)....143
17 Drill indicated estimates of grade and tonnage, Kozak Property (from Anonymous 1981, p. 1)....144
18 Tabulated bulk samples of Norgold Mines Limited as compiled by C.P. Robertson, 1959 (AFRO, Toronto)....145

19 Assay values in excess of 0.10 ounces gold per ton reported on diamond drill logs of Golden Algoma Mines Limited, (AFRO, Toronto)....146
20 Tabulated drilling summary on Rand No. 2 Iron Range. Data from AFRO, Toronto....147
21 Calculated tonnage and grade for pyrite and siderite ore for Aldermac Copper Corporation Limited by Hawley (1942b, p. 22, 23) (AFRO, Toronto)....148
22 Reserve calculations of pyrite within Rand No. 2 Iron Range as proposed by Middleton and Thompson (1969, p. 4) for Duncan R. Derry Limited for Superior Acid and Iron Limited (AFRO, Toronto)....149
23 Calculated grade and tonnage figures for Rand No. 2 Iron Range as prepared by Esson (1969) for Superior Iron and Acid Limited (AFRO, Toronto)....150
24 Possibole siderite orebodies in Bartlett Iron Range based on 1946-1947 diamond drilling of Algoma Steel Corporation Limited (AFRO, Toronto)....151
25 Tabulated gold assays on grab samples taken from Edwards Gold Occurrence. Assays by Mineral Research Laboratory, Ontario Geological Survey....152
26 Tabulated gold values in excess of 0.10 ounces per ton resulting from diamond drilling by Hollinger Consolidated Gold Mines Limited, Edwards Gold Occurrence, Corbiere Township (AFRO, Toronto)....153
27 Conductors identified by Manwa Exploration Services for International Corona Resources Limited, Corbiere Township. Locations approximate on accompanying compilation map (Neelands et al. 1984a)....154
28 Summary of surface diamond drilling on the Josephine Iron Range (AFRO, Toronto)....155
29 Tabulated tungsten assays value on O'Reilly scheelite vein (Mineral Research Laboratory, Ontario Geological Survey)....156
30 Tabulated grab sample assays Soocana-Holdsworth Gold Occurrence, Corbiere Township (Mineral Research Laboratory, Ontario Geological Survey)....157
31 Chemical analysis of Alice Lake Iron Range magnetite, (Collins and Quirke, 1926, p. 97)....158
32 Diamond drilling with assays compiled from maps of the Algoma Steel Corporation Limited, Godon Lake Iron Range, LeClaire Township (AFRO, Toronto)....159
33 Conductors identified by Manwa Exploration Services for International Corona Resources Limited, LeClaire Township. Locations approximate on accompanying compilation map (Neelands et al. 1984a, 1984b)....160
34 Minor elements, Magpie Iron Range siderite....161

35 Analytical data Magpie Mine, presented by the Ontario Iron Ore Committee (1924, p. 160)....162
36 Conductors identified by Manwa Exploration Services for International Corona Resources Limited, Musquash Township. Locations approximate on accompanying compilation map (Neelands et al. 1984a)....163

Figures

1 Index map showing location of map area....
2 Irvine and Baragar AFM plot Hawk Lake granitic complex, Corbiere Township....164
3 Jensen cation plot Hawk Lake granitic complex, Corbiere Township....165
4 Irvine and Baragar AFM plot of intermediate to mafic metavolcanics Leclaire Township....166
5 Jensen cation plot of intermediate to mafic metavolcanics Leclaire Township....167
6 Irvine and Baragar AFM plot of intermediate to felsic metavolcanic rocks, Abotossaway, Corbiere, Leclaire and Musquash Townships....168
7 Jensen cation plot of intermediate to felsic metavolcanic rocks, Abotossaway, Corbiere, Leclaire and Musquash Townships....169
8 Irvine and Baragar AFM plot of wacke metasediments in the area west of Parks Lake, Corbiere Township....170
9 Jensen cation plot of wacke metasediments in the area west of Parks Lake, Corbiere Township....171
10 Irvine and Baragar AFM plot of intermediate to mafic intrusive rocks in Abotossaway and Corbiere Townships....172
11 Jensen cation plot of intermediate to mafic intrusive rocks in Abotossaway and Corbiere Townships....173
12 Irvine and Baragar AFM plot of Gutcher Lake trondhjemite stock rocks, Abotossaway Township....174
13 Jensen cation plot of Gutcher Lake trondhjemite stock rocks, Abotossaway Township....175
14 Irvine and Baragar AFM plot of hypabyssal intrusive rocks, Abotossawy Township....176
15 Jensen cation plot of hypabyssal intrusive rocks, Abotossaway Township....177
16 Irvine and Baragar AFM plot of Lund Lake granodiorite stock, Leclaire Township....178
17 Jensen cation plot of Lund Lake granodiorite stock, Leclaire Township....179
18 Irvine and Baragar AFM plot of Troupe Lake granodiorite Stock, Dunphy Township....180

19 A Jensen cation plot of Troupe Lake granodiorite stock, Dunphy Township....................181
20 Irvine and Baragar AFM plot of intermediate to felsic metavolcanics containing chloritoid, Abotossaway and Corbiere Townships....................182
21 A Jensen cation plot of intermediate to felsic metavolcanic rocks containing chloritoid from Abotossaway and Corbiere Townships....................183
22 Irvine and Baragar AFM plot of intermediate to mafic metavolcanics containing chloritoid from Abotossaway and Corbiere Townships....................184
23 A Jensen cation plot of intermediate to mafic metavolcanic rocks containing chloritoid from Abotossaway and Corbiere Townships....................185
24 Irvine and Baragar AFM plot of chloritoid-bearing intermediate to mafic intrusive rocks, Corbiere Township.....186
25 A Jensen cation plot of chloritoid-bearing intermediate to mafic intrusive rocks, Corbiere Township....................187
26 Irvine and Baragar AFM plot of tourmaline-bearing intermediate to mafic metavolcanic flow rocks, Musquash Township....................188
27 Jensen cation plot of tourmaline-bearing intermediate to mafic metavolcanic flow rocks, Musquash Township.............189
28 Irvine and Baragar AFM plot of altered rocks, Magpie Iron Range, Leclaire Township....................190
29 Jensen cation plot of altered rocks, Magpie Iron Range Leclaire Township....................191
30 Irvine and Baragar AFM plot of Magpie Mine metavolcanics, Leclaire Township....................192
31 Jensen cation plot of Magpie Mine metavolcanics, Leclaire Township....................193
32 Schematic diagram of major geologic structures, Abotossaway, Corbiere, Leclaire and Musquash Townships.......194
33 Stratigraphic column, Josephine Iron Range, Corbiere Township (Modified after Calvert, 1983)....................195
34 Sketch of Gutcher Lake stock and surrounding mineral deposits. Note that copper-gold deposits occur on the north side and quartz vein hosted gold deposits occur on south side....................196
35 Compilation of surface diamond drilling and mineralized zones south of Mall Lake, Ego Resources Limited property. Data compiled from the records of Ego Resources Limited (AFRO, Toronto)....................Back pocket
36 Compilation of surface diamond drilling and mineralized zones of Ego Resources Limited. Data compiled from the records of Ego Resources Limited (AFRO, Toronto).....Back pocket

37 Surface diamond drilling and simplified geology of the Farquhar vein, Abotossaway Township. Compiled from the records of Rio Tinto Canadian Exploration Limited (AFRO, Toronto)..Back pocket
38 Surface diamond drilling and indicated mineralized zones Kozak Property, Abotossaway Township. Compiled from records in AFRO, Toronto and A.C. A. Howe International Limited..Back pocket
39 Surface diamond drilling and geology, Murphy Mine, Abotossaway Township. Compiled from records on file in AFRO, Toronto..Back pocket
40 Surface diamond drilling and geology of the Rand No. 2 Iron Range Map compiled from the records of Superior Acid and Iron Limited and records on file in AFRO, Toronto....Back pocket
41 Surface diamond drilling and geology of the Bartlett Iron Range. Compiled from the Records of the Algoma Steel Corporation Limited (AFRO, Toronto).................Back pocket
42 Surface diamond drilling and outline of the Big Lake Iron Range. Compiled from the records on file in AFRO, Toronto...Back pocket
43 Surface diamond drilling and outline of Central Brooks Iron Range. Compiled from the records on file in AFRO, Toronto...Back pocket
44 Surface diamond drilling and outline of East Brooks Iron Range. Compiled from the records on file in AFRO, Toronto...Back pocket
45 Sample location map for assay samples collected by the Ontario Geological Survey; Edwards Gold Occurrence, Corbiere Township.................................Back pocket
46 Surface diamond drilling and geology of the area surrounding the Edwards Gold Occurrence, Corbiere Township. Compiled from records on file in AFRO, Toronto.......Back pocket
47 Surface diamond drilling and outline of Holdsworth Iron Range, Corbiere Township. Compiled from the records on file in AFRO, Toronto...............................Back pocket
48 Surface diamond drilling and geology of the Josephine Iron Range, Corbiere Township. Compiled from the records of the Algoma Steel Corporation Limited and AFRO, Toronto...Back pocket
49 Surface diamond drilling and geology of the Josephine West Extension Iron Range. Compiled from the records of the Algoma Steel Corporation Limited (AFRO, Toronto).....Back pocket
50 Surface diamond drilling and geology of the Reau-Mary Lakes Iron Range, Corbiere Township. Compiled from the records in AFRO, Toronto..............................Back pocket
51 Surface diamond drilling and outline of iron formation, Sheldon Lake Iron Range, Corbiere Township. Compiled from records on file in AFRO, Toronto...................Back pocket

52 Sketch map showing location of samples collected for assay by the Ontario Geological Survey, Soocana-Holdsworth Gold Occurrence, Corbiere Township....197
53 Surface drilling and vein outline of Soocana-Holdsworth Gold Occurrence, Corbiere Township....198
54 Surface drilling and outline of West Brooks Iron Range, Corbiere Township. Compiled from records on file in AFRO, Toronto....Back pocket
55 Surface diamond drilling and outline of the Alice Lake Iron Range, Leclaire Township. Data from the records of the Algoma Steel Corporation Limited (AFRO, Toronto).....Back pocket
56 Surface diamond drilling and outline of the Godon Lake Iron Range, Leclaire Township. Compiled from the records of the Algoma Steel Corporation Limited, (AFRO, Toronto)....Back pocket
57 Surface diamond drilling and outline of Magpie Iron Range, Leclaire Township. Compiled from records of the Algoma Steel Corporation Limited (AFRO, Toronto)....Back pocket

Photographs

1 Highly stretched intermediate to felsic breccia with occassional mafic clast. Outcrop exposed at Cedar Falls on the Magpie River, Leclaire Township (Location P-1)....199
2 Rounded to very angular intermediate to felsic clasts in a chlorite-rich matrix. Breccia occurs on the west side of the Alice Lake Iron Range, Leclaire Township (Location P-2) Photograph by M. Susek, 1984)....199
3 Intermediate to felsic lapilli tuff in the Reau-Mary Lakes area, Corbiere Township (Location P-3)....200
4 Intermediate to felsic breccia with chlorite-rich matrix. Reau-Mary Lakes area, Corbiere Township (Location P-3)....200
5 Thin bedded metasediment complexely folded and displaying a prominent axial planar cleavage. West Andre Lake, Musquash Township, Photograph by D. England (Location P-5)....201
6 Graded bedding within metasediments consisting dominately of intermediate to felsic metavolcanic rock, West Andre Lake, Musquash Township (Location P-6)....201
7 Dore-type conglomerate, Dunphy Township. Granite cobbles and boulders in wacke matrix (Location P-10)....202
8 Porphyritic texture in Troup Lake granodiorite stock, Dunphy Township (Location P-11)....202
9 Tourmaline along pillow selvages and within cross cutting fractures, southeast corner of Musquash Township (Location P-7)....203
10 Tourmaline crystals along fracture surface, southeast corner of Musquash Township (Location P-7)....203

11 Serrated margin of feldspar porphyry dike cutting amygdaloidal pillowed intermediate to mafic metavolcanics east of Mall Lake, Abotossaway Township (Location P-8).......204

12 Headframe above shaft on Kozak Property as it appeared in 1982, Abotossaway Township.....................................204

13 Rusty weathered mineralized fractures as they appear in a trench immediately south of shaft on Kozak Property, Abotossaway Township...205

14 Rotting and rusting equipment at the Murphy Mine site. Photograph taken in summer of 1985.............................205

15 Rotting remains of a mill at the west end of Edwards Lake (local name). Photograph taken in 1982 at the Edwards Gold Occurrence..206

16 Cross cutting phreatic explosion breccia cutting intermediate to felsic metavolcanics of the footwall to the Josephine Iron Range, Corbiere Township (Location P-9).......206

17a Josephine Mine as it appeared in 1946 before closing. Photograph by A. Gallie, Sherritt Gordon Mines Limited.......207

17b Josephine Mine site as it appeared in 1982 when the area was being geologically mapped..................................207

17c Collaring of the main Josephine Mine production shaft in approximately 1942, Photograph by A. Gallie, Sherritt Gordon Mines Limited...208

17d Headframe of Josephine Mine as it appeared during shaft sinking. (Photograph courtesy of the Wawa Chamber of Commerce), Photograph Circ. 1942..............................208

17e Josephine Mine Headframe during shaft sinking circ. 1941. Parks Lake in background is being drained. Photograph looking west across Parks Lake. Photograph by A. Gallie, Sherrit Gordon Mines Limited....................................209

17f Loading facilities on railroad siding at Josephine Mine. Photograph by A. Gallie, Sherritt Gordon Mines Limited.......209

17g Composite photograph of caving ground in former lake bed of Parks Lake. Photographs taken on October 16, 1946 by A. Gallie, Sherritt Gordon Mines Limited........................210

18 Rusting remains of a diamond drill, Soocana-Holdsworth Property, 1982...210

19a Rotting remains of McKinnon railroad trestle across the Magpie River south of the Magpie Mine. Photograph taken in 1982...211

19b Power house at Steephill falls which supplied power to the Magpie Mine (Sutherland 1914)..................................211

19c Collaring of main production shaft at the Magpie Mine (Corkill, 1911)..212

19d Constructing surface facilities and roasting plant at the Magpie Mine (Corkill, 1913)....................................212

19e Underground at the Magpie Mine circ. 1917 (Annual report of the Algoma Steel Corporation, 1918)....213
19f Storage area for sinter and the ore bridge looking east at the Magpie Mine. (Lindman and Bolton, 1917)....213
19g Magpie Mine surface plant looking west and along railroad tracks, (Lindman and Bolton, 1917)....214
19h Surface plant of Magpie Mine looking northwest curc. 1917 (Annual report of the Algoma Steel Corporation, 1918)....214
19i Sinter discharge into storage area at the Magpie Mine (Lindman and Bolton, 1917). In 1983 only the concrete foundations remain and the area is forested with trees up to 0.3 m thick....215

Maps

OFM 223 Precambrian Geology, Abotossaway Township....Back pocket
OFM 224 Precambrian Geology, Dunphy Township....Back pocket
P. 2568 Precambrian Geology of Musquash Township....Back pocket
P. 2607 Precambrian Geology of Corbiere Township....Back pocket
P. 2636 Precambrian Geology of Leclaire Township....Back pocket
Compilation maps (1-5)....Back pocket

Appendix I

Property Descriptions....216
Abotossaway Township....216
Amax Exploration Incorporated (1)....216
   Amax Exploration Incorporated hole (989-13-1) (1-A)
   Amax Exploration Incorporated hole (989-13-2) (1-B)
Banville - Page (2)....217
   Bonzano Exploration Limited
Brandt Group....218
Candela Development Company....218
Cline claim (3)....218
A. Coppellan (4)....218
Doherty Lake South....219
Eccles Lake iron formations....219
Ego Resources Limited (5)....219
   W - 8 Zone (5A)
   C Zone (5B)
   SW showing (5C)
   Unnamed showing (5D)
   Unnamed showing (5E)
   United Canso Gas and Oil Limited drill hole UC-1 (5-F)
   United Canso Gas and Oil Limited drill hole UC-4 (5-G)

United Canso Gas and Oil Limited drill hole UC-6 (5H)
United Canso Gas and Oil Limited drill hole UC-8 (5I)
United Canso Gas and Oil Limited drill hole UC-9 (5J)
United Canso Gas and Oil Limited drill hole UC-10 (5K)
United Canso Gas and Oil Limited drill hole UC-11 (5L)
United Canso Gas and Oil Limited drill hole UC-12 (5M)
United Canso Gas and Oil Limited drill hole UC-13 (5N)
Unites Canso Gas and Oil Limited drill hole UC-14 (50)
Unites Canso Gas and Oil Limited drill hole UC-15 (5P)
Unites Canso Gas and Oil Limited drill hole UC-16 (5Q)
Ego Mines Limited
United Canso Gas and Oil Limited
Union Minere Explorations and Mining Corporation Limited

Farquhar Vein (6) 229
- Golden Algoma Mines Limited
- Rio Tinto Canadian Exploration Limited

Getty Mines Limited (7) 231
- Middleton Grid, Getty Drill hole GO-6 (7A)
- Kozak Grid, Getty Drill hole GO-6 (7B)

Glenburk Mines Limited 232
International Corona Resources Limited (43) 232
Jonsmith Mines Limited 232
Kozak Property (8) 232
- Nipissing Mining Company
- N. Timmins Incorporated
- Kozak Gold Mines Limited
- Orecana Mines Limited
- American Yellowknife Gold Mines Limited
- Adonis Mines Limited
- Fordham, J.
- Lake Kozak Mines Limited
- A.C.A. Howe International Limited
- Laurasia Resources Limited
- Golden Spoke Mines Limited

R.J. McGowan 235
McMahon Claim 236
Murphy Gold Mine (9) 236
- Murphy Claims
- Goudreau Gold Mines Limited
- New Goudreau Gold Mines Limited
- Bennett-Pacaud Mines Limited
- Algold Mines Limited
- Erie Canadian Mines Limited
- Amherst Gold Mines Limited
- Norgold Mines Limited
- Omar Gold Mines Limited
- Golden Algoma Mines Limited

   International Corona Resources Limited
Paquette..243
Porter - Premier (10)...243
Rand No. 2 Iron Range (11)......................................244
   Morrison
   Rand Consolidated Mines Limited
   Aldermac Copper Corporation Limited
   IRUSGO Consolidated Mines Limited
   Superior Acid and Iron Limited
Realm Mining Corporation Limited................................248
Robinson Claims...248
Rutledge Iron Range (42)..248
Union Miniere Explorations and Mining Corporation Limited (12)...249
Corbiere Township...249
Banner Gold Mines Limited.......................................249
Bartlett (Britannia) Iron Range (13)............................249
   Algoma Steel Corporation Limited
Big Lake iron Range (14)..251
   Jalore Mining Company Limited
   Canadela Development Company Limited
   Jogran Mines Limited
   Getty Mines Limited
Central Brooks Iron Range (15)..................................254
   Lake Superior Corporation (Algoma Steel Corporation Limited)
   Jalore Mining Company Limited
Cline Lake Iron Range (16)......................................256
   Cline, James
   Jalore Mining Company Limited
   Getty Mines Limited
East Brooks Iron Range (17).....................................257
   Lake Superior Corporation (Algoma Steel Corporation Limited)
   Jalore Mining Company Limited
Edwards Gold Occurrence (18)....................................259
   Edwards, Peter
   Peter Rock Mining Company Limited
   Hollinger Consolidated Gold Mines Limited
   Canamax Resources Limited
Getty Mines Limited...262
Holdsworth Iron Range (19)......................................262
   Algoma Steel Corporation Limited
   Grasselli Chemical Company Limited
   Canadian Pyrites Limited
   Dupont of Canada Exploration Limited
   O'Reilly, Dennis
   Falconbridge Limited
International Corona Resources Limited (44).....................265
Jalore Mining Company Limited...................................265

Josephine Iron Range (20) 265
   Historical Resume
   Wiley, H.A.
   Lake Superior Corporation (Algoma Steel Corporation Limited)
   Algoma Steel Corporation Limited
   Michipicoten Iron Mines Limited
   Algoma Steel Corporation Limited
Josephine West Extension Iron Range (21) 276
   Algoma Steel Corporation Limited
Newric Iron Range (22) 277
O'Reilly Scheelite Vein (23) 278
Reau-Mary Lakes Iron Range (24) 278
   Jalore Mining Company Limited
   Candela Development Company Limited
Sheldon Lake Iron Range (25) 280
   Jalore Mining Company Limited
   Candela Development Company Limited
Soocana-Holdsworth Gold Occurrence (26) 281
   Holdsworth Gold Mining Company
   Soocana Mining Company Limited
   Falconbridge Nickel Mines Limited
   Erie Canadian Mines Limited
   Compass Gold Mines Limited
   Sylvanite Gold Mines Limited
   Falconbridge Limited
West Brooks Iron Range (27) 284
   Lake Superior Corporation (Algoma Steel Corporation Limited)
   Jalore Mining Company Limited
Leclaire Township 286
Acme Oil and Gas Company Limited (28) 286
   Acme Oil and Gas Company Limited drill holes 7,8,9,and 10 (28-A)
   Acme Oil and Gas Company Limited drill holes 16 & 17 (28-B)
Alice Lake Iron Range (29) 287
   Lake Superior Corporation (Algoma Steel Corporation Limited)
   Jalore Mining Company Limited
Godon Lake Iron Range (30) 289
   Lake Superior Corporation (Algoma Steel Corporation Limited)
   Algoma Steel Corporation Limited
Holiday - Bingham Galena Occurrences (31) 290
International Corona Resources Limited (45) 291
Magpie Iron Range (32) 291
   Historical Resume
   Lake Superior Corporation (Algoma Steel Corporation Limited)
   Jalore Mining Company Limited
   Algoma Steel Corporation Limited
Mason - Wilbur Prospect 297

McGowan, R.J..297
Noranda Exploration Company Limited (33)...........................298
Noranda Exploration Company Limited drill hole 1-81 (33-A)
North Evans Creek Iron Range (34)..................................299
Algoma Steel Corporation Limited
Reynolds Iron Range (35)...300
Algoma Steel Corporation Limited (Gibson Claims (35-A)
South Evans Creek Iron Range (36)..................................302
Algoma Steel Corporation Limited (36-A)
Union Miniere Exploration and Mining Corporation Limited (37)....303
Union Miniere Exploration and Mining Corporation drill hole Wa-3 (37-A)..303
Union Minere Exploration and Mining Corporation drill holes Wa-9 and Wa-10 (37-B)
Union Minere Exploration and Mining Corporation drill hole Wa-5 (37-C)

Musquash Township..........................304
Acme Oil and Gas Company Limited (38)..............................304
Algoma Steel Corporation Limited (Wagner Anomaly) (39)...........304
Amax Exploration Incorporated (40).................................305
Amax Exploration Incorporated diamond drill hole 989-09-1 (40-A)
Amax Exploration Incorporated dimond drill hole 989-09-2 (40-B)
International Corona Resources Limited (46)......................306
Jalore Mining Company Limited
Reynolds Iron Range (35)...306
Noranda Exploration Company Limited
Union Minere Exploration and Mining Corporation Limited (41)

Conversion Table...308

ABSTRACT

Abotossaway, Corbiere, Leclaire and Musquash Townships and part of Dunphy Township are dominantly underlain by supracrustal rocks of Archean age. The supracrustals consist of metavolcanics, metasediments and intrusions of mafic to felsic composition. The intermediate to mafic metavolcanics are dominantly pillowed and massive but thin units of breccia and tuff are present. The intermediate to felsic metavolcanics consist of flows, tuff, laminated tuff, feldspar crystal tuff, quartz-feldspar crystal tuff, lapilli tuff and breccia. The coarsest breccias occur below the Josephine-Bartlett Iron Range, at the Magpie Mine, and in scattered locations within Corbiere and Leclaire Townships. The coarse breccia at the Magpie Mine contains blocks up to 1 m in size and may have been deposited proximal to a vent.

Metasediments are common in the area and form a distinct unit that strikes northwest and extends through Corbiere Musquash and Leclaire Townships. These metasediments are dominantly wackes. A wacke sequence with rare conglomerate horizons comprises the most northernly located supracrustals in Leclaire and Abotossaway Townships and part of Dunphy Township. Wacke displaying well developed crossbedding and rare ripple marks occur in southwestern Corbiere Township.

Iron formations are common in the area. Michipicoten-type iron formation with sulphide-siderite at the base is the dominant iron formation. However, more typical Algoma chert-magnetite iron formation occurs in northern Abotossaway and Leclaire Townships and part of Dunphy Township. The best developed iron range within this four township area is the Josephine-Bartlett Iron Range located in southern Corbiere Township. This is a Michipicoten type iron formation with pyrite and carbonate facies.

The metavolcanics and metasediments are intruded by numerous mafic intrusions that generally vary in composition from gabbro to quartz diorite.

Several granitic stocks intrude the supracrustals and hypabyssal (near surface) intrusions are common in Corbiere and Abotossaway Townships. In Leclaire Township a small plug of granodiorite to quartz monzonite occurs on Lund Lake, and in the centre of Abotossaway Township the trondhjemitic Gutcher Lake Stock is located. Mineralization within the supracrustal rocks enclosing the Gutcher Lake Stock stimulated much prospecting in the area.

Fine grained massive hypabyssal intrusions occur on or near Big, Perry, and Middleton Lakes. These fine grained intrusions may be coeval to the Gutcher Lake Stock.

In Dunphy Township the Troupe Lake granodiorite to quartz monzonite stock is characterized by a coarse grained porphyritic texture.

The structural geology of these four townships is complex. Two major anticlinal folds are present. The Centre anticline located in Leclaire Township and the Alden anticline located in the northeastern Corbiere are prominent fold structures within the supracrustal rocks.

Strike-slip faulting is common with the most notable fault being the Magpie River Fault which is situated along the top of the Josephine-Bartlett Iron Range. Other strike-slip faults occur between Mall and Middleton Lakes and define a northeast striking linear north of Middleton Lake in Abotossaway Township. Shearing or faulting also occurs along Perry and Selkirk Lakes in Abotossaway Township and along Iris Lake in Dunphy Township.

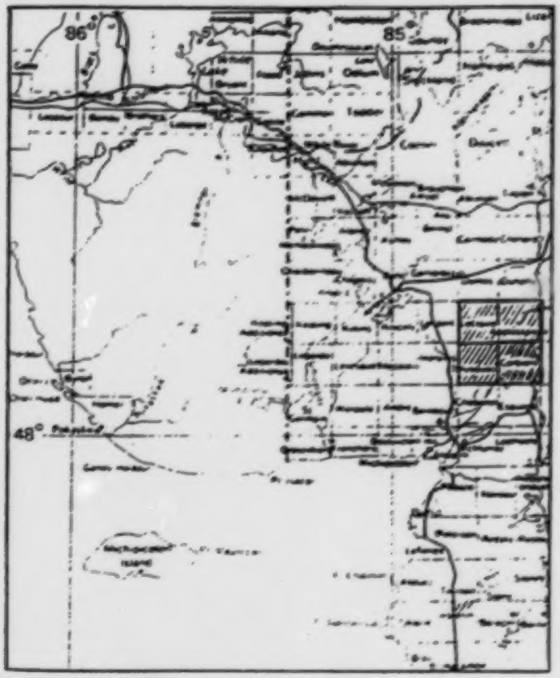
The transverse Marsden Fault is a prominent northwest striking fault crossing Corbiere and Abotossaway Townships. Correlation across this fault is difficult if not impossible. Along the eastern margin of the map area the north-south striking McVeigh Creek Fault occupies a prominent topographic linear.

Secondary structures such as schistosity commonly but not always parallel primary stratification.

The supracrustal rocks have been regionally metamorphosed to a greenschist rank with amphibolite rank being reached along the northern and southeastern contacts adjacent to the external granites. These higher grade rocks result from contact metamorphism at the time of external granite emplacement. An area of tourmaline alteration occurs in southeastern Musquash Township and calcium-sodium alteration has affected the rocks below the Magpie Mine Iron Range. Chloritoid porphyroblasts are common in the area. The zones in which chloritoid is developed crudely follow stratigraphy.

The area has had two operating iron mines and one former producing gold mine and has been unsuccessfully prospected for base metals. The potential for additional iron ore production from these four townships is low. A potential does exist for base metal occurrences and more work is warranted. The greatest economic

potential appears to be gold. Numerous gold showings are present and warrant additional evaluation and the potential for additional discovery appears good.



LOCATION MAP

Scale: 1: 1 584 000
or 1 inch to 25 miles

Geology of Abotossaway, Corbiere, Leclaire and Musquash Townships and part of Dunphy Township, District of Algoma.

by R.P. Sage

Geologist, Precambrian Geoscience Section, Geoscience Branch, Ontario Geological Survey, Sudbury.

Geology of Abotossaway, Corbiere, Leclaire and Musquash Townships and Part of Dunphy Township

District of Algoma

by

R.P. Sage1

INTRODUCTION

This is the second of a series of four reports dealing with the geology of the Wawa area. The first report contains an extensive review of the earlier literature on the Wawa supracrustal rocks (Sage 1987a). Mapping within Abotossaway, Corbiere, Leclaire and Musquash townships was started in 1981 and completed in 1985.

Intense exploration activity in the area for the past 80 years has been concentrated on iron ore and gold. There are two former producing iron mines in Leclaire and Corbiere townships and one former producing gold mine in Abotossaway Township.

In 1987, the supracrustal rocks underlying the southeast corner of Dunphy Township were examined. Mapping of Dunphy Township was undertaken to; correlate the rock units in Abotossaway and Finan townships, provide data on the metasedimentary rocks occurring along the supracrustal-granite contact, and determine if the metasedimentary rocks truly faced northward towards the external granites and thus would be conformable with the metavolcanic rocks to the south.

LOCATION AND ACCESS

These map area is centred at approximately Long.84°40'00 W and Lat.48°11'30" N.

The northern two thirds of Corbiere, the southern half of Abotossaway, nearly all of Musquash Township and the north central portion of Leclaire Township are accessible only by helicopter. The Josephine Mine in southwestern Corbiere Township and the Kozak property in southeastern Abotossaway Township are accessible by foot path or all-terrain vehicles. The Algoma Central Railway follows alongside McVeigh Creek permitting access to the east side of Corbiere and Abotossaway townships. The spur line off the Algoma Central Railway to Wawa permits access to the southern part of Corbiere Township.

---

1 Geologist, Ministry of Northern Development and Mines, Ontario Geological Survey, Precambrian Geology Section, Toronto.

Central Leclaire Township is accessible by a very rough road that goes east from Highway 17 to the Magpie River. A rough road goes west from Goudreau to the Murphy Mine in central Abotossaway Township. Numerous trails lead north and south from the road to the Murphy Mine.

A network of abandoned logging roads permits access to the northern portions of Leclaire and Abotossaway townships. This network can be reached by a rough road going south from the Dubreuilville access road approximately 6.5 km west of Dubreuilville. A log bridge across the Magpie River north of the north boundary of Abotossaway Township gives vehicle access to northern Abotossaway Township.

The four townships are part of a land grant given to the Algoma Central Railroad in 1900. With the exception of isolated claims and claim blocks prospecting activity is under control of the Algoma Central Railroad headquartered in Sault Ste. Marie, Ontario. The location of the map area is shown in Figure 1.

Access to eastern Dunphy Township in 1987 was from the right-away of the Algoma Central Railway and portage via Sherman and Troupe lakes. The western part of Dunphy Township underlain by supracrustal rocks is accessible via an abandoned system of logging roads that can be reached through Abotossaway Township.

ACKNOWLEDGEMENTS

Many individuals have contributed to the mapping of this area (Table 1). Mapping of the area was done concurrently with mapping of the adjoining four townships to the east.

In 1987, mapping in Dunphy Township was assisted by Mr. R. Borthwick and A. Lisowyk, senior geological assistants and by C. Pare, A. Sen, M. Durose, and A. Dallmann.

The author was assisted in figure preparation by N. Dupre, Z. Rebic, J. Turner, T. Calvert, D. MacMillan, R. Steenstra, D. Walker, M. St. Piere, Mr. J. Webb, and A. Lisowyk.

Fixed wing aircraft support was obtained from Hawk Airways Limited, Hawk Junction, Ontario. Helicopter support was provided by the Ministry of Natural Resources, Wawa.

Former District Managers, Ministry of Natural Resources, Wawa, Mr. W. Straight and Mr. G. Murphy helped expedite the project. Mr. C. Clark, present District Manager, Ontario Ministry of Natural Resources, Wawa has supported the mapping activity.

Mr. E. Frey, District Geologist, Ministry of Northern Development and Mines has provided liaison between the mapping party and district personnel of the Ministry of Natural Resources. Mr. G. Mitchell loaned the survey a cabin on Murphy Lake in central Abotossaway Township to serve as a camp during 1985.

Mr. J. Wiume, Ministry of Natural Resources provided junior ranger support for the mapping party.

Numerous Ministry of Natural Resources staff have provided logistical and material support for the project during the years of mapping activity.

Mr. J. Huddart, former Exploration Manager, Algoma Steel Corporation, Sault Ste. Marie provided the survey with exploration data and Mr. E. Berdusco, Algoma Ore Properties Limited, Wawa continues to provide valuable geologic data. Canamax Resources Incorporated and Getty Mines Ltd. provided regional exploration data.

Mr. N. Trowell provided scientific editing for this report.

PHYSIOGRAPHY

Corbiere and most of Musquash townships have abundant outcrop. Topographic relief in this area on the order of several hundred metres.

Outcrop is abundant and topographic relief relatively rugged north to Mall Lake in Abotossaway Township. Outcrop is relatively abundant but topographic relief more subdued north to central Leclaire Township. North of Mall Lake and from the centre of Leclaire Township northward the topographic relief is much flatter and outcrop become more widely spaced.

McVeigh Creek, along the east side of Corbiere and Abotossaway townships, occupies a deep valley from which at its southern end, rocky hills rise on either side 300 to 400 feet above the creek bed. This topographic feature is fault controlled and becomes less developed north of Goudreau.

Flat sand plains with abundant jack pine growth occur along the Magpie River and within the northern part of Leclaire and Abotossaway townships.

The terrain within Dunphy Township is undulating with relatively little flat ground.

FIELD PROCEDURES

Mapping was done on a scale of 1:15,840. Published airborne geophysical maps (1963a, 1963b, 1963c, 1963d) from the government and unpublished airborne geophysical maps from the Assessment Files Research Office were consulted for correlation purposes. Previously published and unpublished geological maps were consulted in placing some rock contacts.

Thin sections were prepared from a selected group of samples. Granitic rocks were classified according to Ayres (1972).

PREVIOUS WORK

One of the earliest major contributions to the regional geology of the area was Collins and Quirke (1926) of the Geological Survey of Canada. The Ontario Geological Survey published a number of reports on the area. The major studies are those of Parsons (1915), Gledhill (1927), Moore (1931), Bruce (1940) and Moore and Armstrong (1946). Since 1960, A.M. Goodwin has published several papers on Michipicoten geology. These papers are cited in the previous report (Sage 1987a) and pertinent papers are cited in this report. Turek et al. (1982, 1984) have undertaken a program of U-Pb isotopic age dating in the Wawa area. Studemeister (1982, 1983, 1985a, 1985b, 1985c) completed a detailed study of the Gutcher Lake Stock in central Abotossaway Township.

Numerous unpublished theses on geology of the Michipicoten area are on file at the Mines Library, Ontario Geological Survey. The Assessment Files Research Office (AFRO) of the Ontario Geological Survey contains a large number of brief property reports.

GENERAL GEOLOGY

The rocks underlying the map area are supracrustal rocks of Archean age. Metasedimentary rocks are greatly subordinate to metavolcanic rocks in areal extent. External granitic rocks occur in the northern part of Dunphy Leclaire and Abotossaway townships and the extreme southeastern corner of Corbiere Township.

Along the southern part of Corbiere Township, the supracrustal rocks strike northeast, east and then southeast, face north, and dip vertically to subvertically (see accompanying maps). The north facing stratigraphic section is capped by Michipicoten Iron Formation which is the faulted on-strike continuation of the iron formation found at the Helen Iron Range near Wawa, in Chabanel Township.

The rocks above the iron formation in southern Corbiere Township dip subvertically, strike northwest, and face south. The Magpie River Fault separates these opposing stratigraphic packages.

In adjoining Musquash Township, the south-facing, northwest-striking stratigraphy becomes increasingly recumbent and forms the south limb of the Centre Anticline centered in Leclaire Township to the northwest. The north limb of this fold is highly attenuated and lies in fault contact with metavolcanic rocks and chert-magnetite iron formation along Evans Creek.

The Centre Anticline is cut off to the east by the Marsden Fault.

East of the Marsden Fault the Alden Lake Anticline is cross folded and a minor syncline known as the Sheldon Lake Syncline is indicated by opposite south- and north-facing supracrustal rocks in the Sheldon Lake (local name) area. The metavolcanic rocks on the north side of the Alden Lake Syncline face north. Primary structures within the metavolcanic and metasedimentary rocks indicate a north-facing stratigraphic sequence at the external granite-supracrustal contact located in the extreme northern portion of Abotossaway and Leclaire townships.

The rocks of the map area are separated from rocks of the adjacent map area to the east by faulting along McVeigh Creek.

Most iron formations within the map area are Michipicoten-type with characteristic well-developed carbonate and sulphide facies, however, along the northern margin of Leclaire and Abotossaway townships and in Dunphy Township, a banded chert magnetite iron formation forms a distinctive unit. This banded chert magnetite iron formation does not have the carbonate and sulphide facies that typifies the Michipicoten-type iron formation.

The supracrustal rocks have been intruded by granitic stocks that vary widely in composition. In Leclaire Township, a small granitic stock occurs at Lund Lake. In central Abotossaway Township, the Gutcher Lake Stock intrudes the supracrustal rocks. In Leclaire Township, several isolated granitic intrusions occur east and north of the former Magpie iron mine. In Dunphy Township, a coarse-grained porphyritic granodiorite to quartz monzonite stock is centered on Troupe Lake.

Fine-grained hypabyssal felsic intrusive rocks are found at Big Lake, Perry Lake, at Middleton Lake, north of Middleton Lake, and in the area south and east of the Gutcher Lake Stock, Abotossaway Township. These intrusive rocks may be the fine-grained equivalents to, and coeval with the Gutcher Lake Stock with which they have somewhat comparable compositions and form a crudely encircling outcrop pattern.

The border phase of the Gutcher Lake Stock is a quartz feldspar porphyry and apophyses of this rock extend out into the surrounding supracrustal rocks. A thermal aureole of contact metamorphism 0.5 km to 1.0 km wide encloses the Gutcher Lake Stock.

Large mafic intrusive bodies occur in the map area. The most extensive distribution of these intrusive rocks is found between Big Lake and Alden Lake in Corbiere Township and in the southeast corner of Abotossaway Township. The mafic intrusions are gabbro to quartz diorite in composition.

The area is cut by northeast- and northwest-striking diabase dikes. The conjugate trend of the diabase is best exhibited in Leclaire Township. Diabase dikes are particularly abundant in proximity to zones of faulting such as the Marsden Fault.

The area has been glaciated and sandy outwash is common along the northern parts of Leclaire and Abotossaway townships.

Table 2 presents the rock units found in the map area.

ARCHEAN

EXTERNAL GRANITIC ROCKS (MAP UNIT 1)[2]

External granitic rocks are poorly exposed along the extreme northern edge of Leclaire and Abotossaway townships. External granitic rocks of the Hawk Lake Granitic Complex are well exposed in the extreme southeastern corner of Corbiere Township.

The external granitic rocks are discussed first since at the beginning of the geologic mapping of the Wawa area the external granitic rocks were considered to be the older rocks. Subsequent U-Pb isotope age dating by Turek et al. (1984) indicated that the external granitic rocks are commonly younger than the supracrustal rocks. However, in order to maintain consistency between map sheets and previously prepared reports, the earlier order of discussion will be retained.

NORTH CONTACT

Granitic rocks of trondhjemite to granodiorite composition along the north contact are very poorly exposed. The best exposure of outcrop lies in the extreme northeastern corner of Leclaire Township. The granitic rocks weather pink to pale red and are pale pink to red on fresh surface. In outcrop, the granitic rocks have a weak schistosity and the quartz appears podiform and recrystallized.

In thin section, the rocks are fine- to medium-grained equigranular, allotriomorphic, granoblastic with curved to lobate grain boundaries. In one specimen, close to the supracrustal-granite contact, the quartz and plagioclase were concentrated in ribbons and the rock appeared to be a recrystallized mylonite. A second sample contained large grains of plagioclase altered to sericite in a granoblastic groundmass. These larger feldspar grains may be porphyroclasts in a recrystallized matrix. The texture of these two samples is a recrystallized cataclastic texture rather than an igneous texture. The mode of these two thin sections is estimated as 30 to 35% quartz, 40 to 60% plagioclase (An 34?) and 0 to 20% biotite. Trace amounts of sphene, zircon, opaques, and chlorite were noted. Sericite and epidote after plagioclase form between 10 and 15% of the rock. One specimen had 10 to 15% microcline.

---

[2] The external granitic rocks are discussed first since at the beginning of the geologic mapping of the Wawa area the external granitic rocks were considered to be the older rocks. Subsequent -P isotope age dating by Turek et al. (1984) indicated that the external granitic rocks are commonly younger than the supracrustal rocks. However, in order to maintain consistency between map sheets and previously prepared reports, the earlier order of discussion will be retained.

The microcline is clear, fresh, anhedral, and interlocks with the quartz and plagioclase. The freshness of the microcline suggests it completely recrystallized or perhaps is formed as a result of a post-deformation metasomatic event. The quartz displays well developed wavy extinction. The plagioclase is altered and flecked with sericite and epidote. The altered nature of the plagioclase contrasts sharply with the fresh microcline.

The contact relationship between the external granitic and the supracrustal rocks is obscure in Leclaire and Abotossaway townships. To the east, along the northern edge of the supracrustal rocks in Jacobson Township, the author has observed that granitic dikes cut the supracrustal rocks close to the granite-supracrustal rock contact. Several of the granitic outcrops in Jacobson Township display textures such as podiform recrystallized quartz suggesting deformation and recrystallization. On the basis of very limited exposure and thin section examination, the granitic supracrustal contact is interpreted to have been originally intrusive and subsequently overprinted by deformation and recrystallization. A late metasomatic event may have introduced potassium feldspar.

Turek et al. (1984) obtained a U-Pb age of 2662±5 Ma on an external granite exposed in a road cut along the main highway to Dubreuilville. This age is younger than U-Pb ages obtained from the volcanic rocks forming the Michipicoten supracrustal sequence and is consistent with the limited field observations that an intrusive relationship exists between the external granitic and supracrustal rocks (Turek et al. 1982, 1984).

Outcrops of external granitic rocks in Dunphy Township are widely spaced and generally of limited extent. Intrusive or crosscutting relations between the external granitic and supracrustal rocks were not observed in Dunphy Township but have been established in railroad rock cuts in northern Jacobson Township (Sage 1987c).

The external granitic rocks in Dunphy Township weather pink to buff and are pink, buff or grey on fresh surface. On the basis of visual identification, the rocks are classified dominantly as granodiorite, but some have a tendency towards trondhjemite and quartz diorite compositions. Outcrops some distance from the interpreted supracrustal-granitic rock contact display a typical igneous texture while some outcrops close to the interpreted outcrops display a well-developed schistosity. Outcrops close to the supracrustal contact appear deformed and weakly cataclastic.

INTERMEDIATE TO MAFIC METAVOLCANIC ROCKS (MAP UNIT 2)

Intermediate to mafic metavolcanic rocks underlie 40 to 50% of the map area. Over 90% of these rocks are massive or pillowed and some of the more massive outcrops may be comagmatic sills rather than flows. Intermediate to mafic tuffs and breccias are not common.

In the area along the southern boundary of Corbiere Township, the pillowed intermediate to mafic metavolcanic rocks locally contain amygdules up to 1 cm in diameter. These amygdules are dominantly carbonate-filled but some may contain white granular quartz, possibly recrystallized chert. At the top of the intermediate to mafic metavolcanic section, the flows are heavily impregnated with rusty weathering carbonate. Chloritoid may comprise up to 15 to 20% of some of these carbonate-rich outcrops. In spite of the extensive and pervasive alteration recognizable, pillow selvages may be so well preserved that they can be used to determine facing directions.

In central Corbiere Township, massive and pillowed metavolcanic rocks are common. In the area of Reau and Mary lakes, Corbiere Township, the amygdaloidal pillowed lavas interdigitate or interfinger with massive metavolcanic rocks. In this area, the pillows are commonly horseshoe shaped and this interdigitating pattern is interpreted to be the result of shearing at an oblique angle to the bedding. The sheared pillows cannot be used to determine reliable facing directions. Amygdules in some of these flows exceed 1 cm in diameter.

Intermediate to mafic pillowed to massive metavolcanic rocks underlie most of Musquash Township. Pillow tops indicate a vertical to overturned southwest-facing sequence.

Good pillowed to massive intermediate to mafic metavolcanic rocks occur from Reau-Mary lakes in Corbiere Township to Perry, Selkirk, and Doherty lakes in Abotossaway Township. Pillow shapes in this area can often be used to determine facing directions. North of Perry and Selkirk lakes the pillow structures are too deformed to be used for facing determinations unless they occur in the less deformed hornfelsed rocks marginal to the Gutcher Lake Stock. The intermediate to mafic metavolcanic rocks from Mall Lake to Middleton Lake and continuing to the northeast have recognizable pillow structures but deformation has generally been intense and their shapes cannot generally be used to determine facing directions. These massive to pillowed intermediate to mafic metavolcanic rocks grade stratigraphically upward into a dominantly tufaceous stratigraphy that locally displays bedding. These intermediate to mafic tuffs then appear to be gradational upwards into the metasedimentary rocks that form the northern portion of the supracrustal sequence.

Within the intermediate to mafic metavolcanic rocks south of Mall and Middleton lakes and north of Perry, Selkirk, and Doherty lakes, there are numerous exposures of amygdaloidal flows and amygdaloidal pillowed flows. These outcrops weather pitted and rough. The former gas cavities may exceed 2 cm in diameter and in some of the larger exposures faint outlines of stretched pillow structures can be seen. The amygdules may comprise up to 20 to 30% of the flow rock and may be relatively evenly distributed. In general, pillowed amygdaloidal flows display a concentration of the amygdules in the pillow rim. These amygdules may be almond-shaped but sometimes they are elongate or pipe-like and oriented with their long axis normal to the pillow rim.

In southwestern Leclaire Township, the pillowed to massive intermediate to mafic metavolcanic rocks are subvertical to overturned and dip north. On the basis of pillow shape and limited facing data in the band of metasedimentary rocks that strikes northwest across the township within the massive to pillowed section, the section faces south and there are no reversals in facing direction. On Reynolds Lake, several outcrops were found in which massive flows graded into pillows which grade into brecciated pillows, which then in turn grade into an isolated pillow breccia. This vertical variation in structure within individual flow units gave facing data consistent with that determined solely by pillow shape and is as described by Carlisle (1963). The intermediate to mafic metavolcanic rocks in southwestern Leclaire Township displaying well-developed pillows lie on the south limb of the Centre Anticline.

The pillow structures within the intermediate to mafic metavolcanic rocks that form the north limb of the Centre Anticline are too deformed to determine facing directions. As Evans Creek is approached, the rocks become increasingly more schistose. North of Evans Creek, pillow structures were not recognized and the intermediate to mafic metavolcanic rocks are fine-grained tuffs with locally recognizable bedding. These tuffs appear to grade northward into metasedimentary rocks that separate the metavolcanic rocks from the external granitic rocks.

The large size of the amygdules in the pillowed and amygdaloidal flows in combination with their abundance and wide distribution indicates flows with a consistently high volatile pressure or emplacement under low confining pressures (Moore 1965; Jones 1969). Studies of metasedimentary rocks that are associated with the intermediate to mafic metavolcanic rocks indicate that fluviatile and even subaerial conditions existed at the time of intermediate to mafic volcanism (Neale 1981, Thomas 1984). Therefore the large and abundant amygdules most likely suggest emplacement under low confining pressure or shallow water conditions.

Lying above the pillowed to massive intermediate to mafic metavolcanic rocks and below the intermediate to felsic metavolcanic rocks below the Josephine-Bartlett Iron Range is a distinctive intermediate to mafic polymictic breccia that marks the break between mafic and felsic volcanism of cycle one. Within this map area, this unit extends from Parks Lake in the southwest corner of Corbiere Township to Siderite Lake in eastern Corbiere Township, however, the unit continues to the southwest and lies below the Ruth and Lucy iron ranges in Chabanel Township (Sage 1987a). The unit is pervasively impregnated with carbonate, contains dominantly angular intermediate composition clasts up to block size, is matrix supported, and does not display recognizable bedding. This same unit occurs below the Lucy Iron Range, Chabanel Township, where it is generally oligomictic consisting of light grey clasts of intermediate composition in a dark green mafic matrix but scattered grey chert clasts may locally be found. Within Corbiere Township, mafic clasts and angular fragments of iron formation derived chert and pyrite are present.

Reaction rims up to 1 cm in width are present on some clasts. These rims are lighter coloured than the clast core. The reaction rims imply the unit could have been warm at the time of emplacement.

At the Lucy Iron Range, variation in fragment size over a nearly continuous exposure suggests that the mafic breccia may represent deposition of at least three flow units (Sage 1987a). This breccia unit forms a distinctive marker horizon from the Lucy Iron Range in Chabanel Township to the east end of the Josephine-Bartlett Iron Range at Siderite Lake.

The type exposure of the mafic breccia is on the south side of Brooks Lake below the Lucy Iron Range in Chabanel Township and at this site other textural features can be observed (Sage 1987a).

At an unnamed lake in the northwest corner of Musquash Township, a number of outcrops of polymictic mafic volcanic breccia were noted. The clasts are up to 0.3 m in size and vary from angular to rounded. The breccias are dominantly matrix supported and bedding is absent. The units appear to be generally thin, being on the order of 2 to 3 m in thickness and lying between massive flows. There is an absence of reaction rims on the fragments and pumiceous material was not observed. Up to 20% of the breccia clasts are composed of fine-grained, aphanitic intermediate to felsic metavolcanic rocks, up to 40% are medium-grained, equigranular metagabbro or metadiorite. The matrix is a fine-grained mafic tuff. Flow banding was noted in one intermediate to felsic volcanic clast. The contact of the breccia with massive mafic metavolcanic rocks was observed to be sharp.

On the basis of the degree of clast rounding, polymictic character, and general absenc of reaction rims or other features that could imply a dominantly volcanic origin these breccias could be interpreted as very thin interflow conglomerates. These thin fragmented units could represent minor interflow accommodations of phreatic explosion breccia but evidence for this interpretation is lacking. Their relatively narrow thickness combined with the inability to trace them laterally or define a stratigraphic package where they form a major component has prompted the author to code them as mafic breccias within the mafic metavolcanic rocks on the accompanying map to avoid complexity.

In Abotossaway Township, a mafic lapilli tuff outcrops on the north side of Selkirk Lake. Similar rocks were encountered northeast of Selkirk Lake. The unit may approach 30 m or more in width and is easily recognized in the field by the grey weathered clasts set in a dark green matrix. Detailed mapping in this area may establish continuity to this unit and provide a marker horizon in the northeast corner of Abotossaway Township.

On a small unnamed lake north of Middleton Lake in Abotossaway Township, a thin bedded mafic tuff unit contains concretion-like clusters of plagioclase crystals. The crystals occur in clusters up to 5 cm in diameter. In thin section, the crystals composing the clusters are euhedral and unaltered. On the basis of optical data, the plagioclase has an anorthite content of approximately 35%. The concretion-like plagioclase clusters are in a groundmass of turbid, fine-grained, altered plagioclase of unknown composition, carbonate, chlorite and possibly traces of sericite.

In Leclaire Township, a coarse polymictic intermediate to mafic volcanic breccia is exposed in railroad rock cuts south of the former site of the Alice trestle on the abandoned railroad grade to the Magpie Mine. Clasts of intermediate to felsic composition of dark grey to buff colour up to 1 m in size are present. Smaller intermediate to mafic clasts up to 0.3 m in size are common. The clasts are angular to subrounded and matrix supported. The relative proportion of felsic to mafic clasts varies widely from site to site and stratification was not observed. Possible reaction rims on clasts are rare. The matrix to this breccia is dark green and contains traces of disseminated pyrite. This clastic breccia may represent a debris flow.

Tiny euhedral magnetite crystals up to 1 mm in size are common in the flows in northern Corbiere and southern Abotossaway townships. The magnetite may approach 1 or 2% of the rock. These magnetite-bearing mafic flow units may serve as local geophysical marker horizons.

In thin section, the intermediate to mafic metavolcanic rocks are fine- to very fine-grained making precise optical identification of the mineralogy difficult. Outlines of former plagioclase crystals can commonly be seen but the plagioclase itself has been totally replaced with a secondary mineral assemblage. On the basis of morphology, the original texture may have been fine-grained, equigranular, massive hypidiomorphic with straight to curved grain boundaries. One sample suggests a former ophitic texture. The present texture tends to be granoblastic. The original mineralogy may have been approximately 50% plagioclase and 50% pyroxene.

The present mineralogy is dominantly chlorite, carbonate, epidote, with traces to minor quantities of magnetite, leucoxene, sericite, and quartz. The fine-grained quartz is interpreted to be a product of alteration and not a primary mineral. Acicular amphibole, possibly after clinopyroxene was noted in several thin sections. Chlorite replaces both the feldspar and mafic minerals.

Moore (1931) described the mafic metavolcanic mineral assemblage as chlorite, uralite, serpentine, epidote, zoisite, biotite, carbonate and leucoxene. Biotite was observed by the author to occur only in tufaceous rocks in the northern part of the map area where it is representative of a higher metamorphic grade (biotite amphibolite) as the contact of the supracrustal rocks with the external granitic rocks is approached.

Collins and Quirke (1926) reported that the pillow lavas consist of 75 to 80% secondary hornblende, 5% magnetite and 20% quartz plus feldspar. They describe the pillow rims as consisting of 80% biotite, 5% magnetite and the remainder as carbonate + zoisite. The biotite was considered primary by Collins and Quirke (1926). The mineralogy described by them is consistent with the observation of increasing metamorphic grade as the margins of the supracrustal rocks is approached. The author considers their reported mineral assemblage to be a reflection of metamorphic conditions and not one representative of original mode.

Sampling of the intermediate to mafic metavolcanic rocks was not extensive in this map area but has been previously completed by the author in the adjoining map area (Sage 1987a). Nearly all of this work was on volcanic cycles one and two. Both of these cycles represent bimodal mafic and felsic volcanism separated by Michipicoten-type iron formation. The Michipicoten-type iron formation represents a good marker horizon within the volcanic stratigraphy to divide the two volcanic cycles. Within Leclaire Township, the Centre Anticline is defined geologically and geophysically by the distribution of Michipicoten-type iron formation. This iron formation is represented by the Reynolds, Godon Lake, and South Evans Creek iron ranges. The core of the Centre Anticline is interpreted to be cycle one volcanic rocks and the limbs of cycle two. While in some areas the subdivision of cycle one volcanic rocks from cycle two is difficult, the presence of Michipicoten-type iron formation in the map area makes the separation easy. This separation is based on the assumption that the Michipicoten-type iron formation was at one time a continuous stratigraphic unit, an assumption that awaits confirmation using U-Pb isotopic age dating techniques. In the adjoining area (Sage 1987a), the intermediate to mafic metavolcanic rocks of both cycles one and two are high magnesium to high iron tholeiites (as they plot on a cation diagram). A small group of intermediate to mafic metavolcanic rocks was collected during mapping of the Centre Anticline and the analyses of these rocks is given on an AFM plot and cation plot (Figures 4 and 5). The limited data indicate a high iron tholeiite sequence consistent with what has been observed in the adjoining area. These samples are from cycle one collected in the core of the anticline stratigraphically below the Michipicoten-type iron formation and the cycle two stratigraphically above the Michipicoten-type iron formation.

Intermediate to mafic metavolcanic rocks underlie the southeast corner of Dunphy Township and are a major rock type. The intermediate to mafic metavolcanic rocks are dominantly massive and pillowed, but minor feldspar crystal tuff is also present. The pillows are generally less than 1 m in long dimension and have selvages 2 to 3 cm in width. Some units display well-developed amygdules which may reach a long dimension of approximately 8 mm. On the basis of pillow shape, the intermediate to mafic metavolcanic rocks face north, however, one of the pillow shapes southwest of Troupe Lake suggests the local presence of a south facing section.

The feldspar crystal tuffs contain feldspar crystals up to 3 to 4 mm set in a chlorite-rich matrix. The feldspars compose 5 to 15% of the rock. Tuff becomes more common as the contact with the metasedimentary rocks is approached. The metasedimentary-metavolcanic contact is not a single discrete contact but it appears to be one of alternating volcanism and sedimentation with sedimentation finally superseding volcanism.

The intermediate to mafic metavolcanic rocks weather to various shades of green. On fresh surface, lighter shades of green are characteristic.

In thin section, the feldspar crystal tuff was composed of chlorite, epidote, actinolite, and fine-grained granoblastic untwinned plagioclase. The feldspar crystals were rounded in outline and extensively altered to sericite and epidote.

INTERMEDIATE TO FELSIC METAVOLCANIC ROCKS (MAP UNIT 3)

Intermediate to felsic metavolcanic rocks form a major unit within the map area.

INTERMEDIATE TO FELSIC METAVOLCANIC ROCKS OF CYCLE ONE

The intermediate to felsic metavolcanic rocks below the Josephine-Bartlett Iron Formation are a similar rock package to those found below the Helen, Johnson, Eleanor, Lucy, and Ruth iron ranges. These intermediate to felsic metavolcanic rocks are the faulted eastern extension of the rocks underlying the Helen to Ruth iron ranges. These rocks consist of tuff, bedded tuff, quartz-feldspar crystal tuffs, lapilli tuff, and fiamme-bearing tuff breccias of cycle one volcanic rocks. The best developed fiammes occur in an outcrop due east of the shaft of the Josephine iron mine where they can be found approaching 5 cm in length. The intermediate to felsic metavolcanic rocks are pervasively impregnated with carbonate and commonly weather to a rusty brown color.

In comparing the intermediate to felsic metavolcanic rocks found below the Josephine-Bartlett Iron Range with the section below the Helen Iron Range one finds the absolute quantity of coarse volcanic breccia greatly diminished and the relative quantity of finer-grained clastic rocks greatly increased. At the Helen Iron Range, approximately 2000 m of intermediate to felsic metavolcanic rocks occur below the iron formation. At the eastern end of the Josephine Iron Range, on the east side of Parks Lake, the section is approximately 900 m; thick and at Siderite Lake, at the east end of the Josephine-Bartlett Iron Range, the section is approximately 300 m thick.

The thinning of this unit to the east and diminished quantity of coarse volcanic breccia indicates that the Helen Iron Range overlies rocks originally deposited closer to the centre of volcanism then the Josephine-Bartlett Iron Range.

The primary volcaniclastic textures and flow structures are better developed in the section below the Helen Iron Range (Sage 1987a).

At the East Brooks Iron Range, in the southeastern corner of Corbiere Township and east of the Marsden Fault intermediate to felsic metavolcanic rocks consist of feldspar crystal tuff, laminated to massive tuff and sericite schists. Due to the presence of more than the average amount of chlorite, some of these tuffs approach an intermediate composition.

North of the Josephine Iron Range and west of the Marsden Fault the Central Brooks Iron Range in the centre of Corbiere Township and the West Brooks Iron Range in west-central Corbiere Township are located. Northwest of the West Brooks Iron Range and striking in a northwest direction into Musquash Township is the Reynolds Iron Range. Associated with these iron ranges and also occurring as isolated northwest-striking elongated segments are units of intermediate to felsic metavolcanic rocks. These iron ranges and the associated intermediate to felsic metavolcanic rocks may have once been one continuous rock unit that was segmented during folding and shearing accompanying overturning of the south limb of the Centre Anticline on which they occur.

The intermediate to felsic metavolcanic rocks consist of quartz-feldspar crystal tuff, sericite schist, tuff, massive flows, lapilli tuff, oligomictic and polymictic breccias, and flow banded flows. The rocks are commonly schistose and pervasively impregnated with carbonate. Chloritoid may be present in some of the intermediate to felsic volcanic rocks found in Corbiere Township. Isolated outcrops of well-developed coarse volcanic breccia can be found within the intermediate to felsic metavolcanic rocks on several unnamed lakes northwest of West Andre Lake in Musquash Township and northeast of West Andre Lake in Corbiere Township. The breccias northeast of West Andre Lake are associated with tuffs, and lapilli tuffs.

To the northwest, the Reynolds Iron Range becomes the Godon Lake Iron Range which along strike becomes the South Evans Creek Iron Range. The Godon Iron Range has siderite at its bottom and is a Michipicoten-type iron formation. In the Reynolds Lake area, there are two if not three iron formation units. These are possibly the same iron formation repeated by strike-slip or thrust faulting, most likely before regional folding.

The Magpie Iron Range consists solely of siderite which lies on strike with the Alice Iron Range which has been converted to magnetite due to metamorphism. In mapping this area, the author concluded that intermediate to mafic volcanism took place before siderite deposition in the Magpie Iron Range was completed. Young (1953) reached a similar conclusion. The upper facies of iron formation that characterize the Michipicoten-type iron formation are now represented in the Reynolds - Godon Lake - South Evans Creek iron ranges. These three iron ranges form a mappable horizon that outline the Centre Anticline, the core of which contains a large volume of intermediate to felsic metavolcanic rocks of cycle one.

Within the core of the Centre Anticline the intermediate to felsic metavolcanic rocks are highly schistose and only moderately carbonated. The lower carbonate content contrasts with the pervasive carbonate soaking found in Corbiere Township and in the previous map area (Sage 1987a). The cycle one intermediate to felsic metavolcanic rocks consist of sericite schists, feldspar crystal tuffs, polymictic and oligomictic breccias, massive flows and lapilli tuffs (Plate 1). These intermediate to felsic metavolcanic rocks do not contain significant visible free quartz which is common in the intermediate to felsic volcanic rocks of cycle one within Chabanel, Esquega, McMurray and Lastheels townships (Sage 1987a) suggesting the possibility of a different vent system and less siliceous magma. Spectacular, coarse, dominantly oligomictic volcanic breccias occur below the Magpie and Alice iron ranges. The breccias below the Magpie Iron Range weather buff to pale pink and fracture like chert. The hardness of these breccias prompted the author to originally consider the rocks to have been silicified (Sage 1983) but subsequent chemical data suggests the rocks have been subjected to calcium and possibly sodium rather than silica metasomatism. Some fragments may have originally been of mafic composition since pale green chlorite appears to be present in the cores of the altered clasts. The clasts may exceed 1 m in size but generally are 0.3 m or less. They vary from angular to rounded and the fragment population may approach 70 volume % of the outcrop.

One clast collected from one of the railroad cuts south of the mine appeared relatively fresh and unusually low in sericite content when compared to other samples examined from the area.

In thin section, the rock is fine-grained, seriate and hypidiomorphic with straight to curved grain boundaries. The mode is estimated to be 10 to 15% carbonate, 1 to 3% epidote-zoisite, 5 to 10% quartz and 80 to 90% plagioclase (An2 to 8). Sericite was present in amounts varying from trace to 5%.

The carbonate was present as anhedral grains and fracture fillings. The epidote-zoisite is very fine-grained and scattered throughout the sample as tiny colourless, high relief, anhedral grains. The plagioclase formed tabular grains with weak to moderate saussuritization. A good fluxion texture was indicated by the subparallel orientation of the plagioclase laths.

Along strike and below the Alice Iron Range the fragments are enclosed in a dark green chlorite-magnetite matrix and they are more rounded than those below the Magpie Iron Range (Plate 2). Also, the Alice Iron Range breccias do not appear to be as altered as those below the Magpie Iron Range. Some clasts tend to weather in relief over the chlorite-magnetite-rich matrix.

The volcanic breccia is commonly clast-supported and there is an absence of bedding or stratification. The volcanic breccia clasts in the Alice Iron Range breccias consist almost solely of fine-grained, massive, aphanitic felsic metavolcanic rocks.

Near the south abutment of the former Alice trestle, one large outcrop of coarse oligomictic volcanic breccia was observed that consists of subrounded feldspar porphyry clasts up to 0.5 m in diameter within a feldspar crystal tuff matrix. The breccia is matrix supported and lacks stratification. Feldspar crystals up to 6 mm in seriate distribution form 30 to 40% of the clasts. The feldspar crystals in the matrix are identical to those in the clasts and make up 10 to 20% of the matrix.

Goodwin and Shklanka (1967) described the intermediate to felsic metavolcanic rocks at the Magpie Mine as a lenticular mass 4 miles wide at its southeast end. This width measures the thickest intermediate to felsic metavolcanic rock section within the Centre Anticline.

In the southwest corner of Abotossaway Township, approximately 0.5 miles southwest of Perry Lake, schistose intermediate to felsic metavolcanic rocks occur as tapered units pinching out to the west in the area east of the Marsden Fault. These rocks consist of tuff, sericite schist, lapilli tuff, oligomictic breccia, feldspar crystal tuff, quartz-feldspar crystal tuff, and massive flows intercalated with intermediate to mafic metavolcanic rocks. The north sides of these lenses of intermediate to felsic metavolcanic rocks are often capped with thin units of chert-magnetite iron formation. These iron formation units may represent segments of a once continuous rock unit thrust over itself by strike-slip or thrust faulting in the early stages of regional deformation. Well-developed bedding is generally absent within these intermediate to felsic metavolcanic rocks.

In the southeastern corner of Abotossaway Township, a large area of intermediate to felsic metavolcanic rocks are intruded by quartz diorite to gabbro. These rocks form the core of the Alden Lake Anticline (Plates 3 and 4). The rocks are highly schistose and heavily carbonatized and chloritoid is locally common. They consist of sericite schist, feldspar crystal tuff, lapilli tuff, tuff, massive flows, and oligomictic volcanic breccia. Feldspar crystal tuff is a major rock unit. The Rand No.2 Iron Range occurs along the north side of the Alden Lake Anticline separating the intermediate to felsic metavolcanic rocks from the overlying intermediate to mafic massive and pillowed cycle two volcanic rocks.

Coarse breccia is uncommon in this area of intermediate to felsic volcanism. Some coarse breccia underlies the Rand No.2 Iron Range and several good outcrops of coarse breccia occur on the east side of the Algoma Central Railway tracks north of Alden station. The general absence of coarse breccia implies that the intermediate to felsic metavolcanic rocks do not represent an accumulation close to a vent.

INTERMEDIATE TO FELSIC METAVOLCANIC ROCKS OF CYCLE 2

Intermediate to felsic second cycle metavolcanic rocks are restricted to the southwest corner of Musquash Township. These rocks strike northwest and consist of sericite schist, feldspar crystal tuff, tuff, quartz-feldspar crystal tuff, polymictic and oligomictic breccias, and lapilli tuff. These rocks are schistose and moderately carbonated. These intermediate to felsic metavolcanic rocks lie on top of cycle two intermediate to mafic metavolcanic rocks and interdigitate with Dore-type metasedimentary rocks. A quartz-feldspar crystal tuff along Highway 17 immediately west of the map area have a U-Pb age of 2696±2 Ma (Turek et al. 1982) and coarse breccias of this volcanic centre located in Chabanel Township have an U-Pb age of 2698±11 Ma (Turek et al. 1984). The metavolcanic rocks of cycle two are at least 50 Ma younger than those of Cycle I (Turek et al 1982, 1984).

MISCELLANEOUS INTERMEDIATE TO FELSIC METAVOLCANIC ROCKS OF CYCLE TWO

Along the north side of the fine-grained felsic hypabyssal intrusion north of Middleton Lake, Abotossaway Township, a well-bedded, quartz-feldspar tuff is present which locally displays graded bedding. On the basis of grain gradation, the unit faces north.

This fine-grained hypabyssal intrusion is interpreted to have been emplaced at a very shallow depth and the tuff represents stripping and erosion of the upper surface of the intrusion and is thus a form of regolith at a paraconformity. This paraconformity likely represents only a minor interruption in volcanism.

Numerous chlorite-rich fine-grained wispy clasts are present in this reworked tuff possibly representing reworking and incorporation of overlying mafic tuff material that hosts the intrusion. The intrusive nature of this fine-grained massive unit can be better observed on a similar band located north of Rowan Lake immediately south of the one with the reworked tuff on the north side. North of Rowan Lake, Bruce (1940) noted crosscutting intrusive relations on the felsic band which were confirmed by the author. By analogy with the intrusive band north of Rowan Lake, the underlying fine-grained rock lying along the unnamed lake system is also interpreted as intrusive. The very leucocratic nature of the fine-grained intrusion indicates that it is an unlikely source for the abundant chlorite in the tuff along the north side. This feature combined with local well-developed bedding displaying grain size gradation implies erosion of the upper surface of the intrusion.

Goodwin and Shklanka (1967) drew a north trending line between the coarse volcanic breccias found at the Helen Iron Range, the breccias found north of the Magpie River, and those found at the Magpie Mine. The observation that these occurrences lie along a straight line indicated to them an alignment of volcanic centres and implied a relationship between the three volcanic centres. This correlation was made in spite of intervening faulting and folding between the three sites.

Turek et al. (1982, 1984) dated the intermediate to felsic metavolcanic rocks below the Helen Iron Range as 2749±2 Ma and those north of the Magpie River as 2698±11 Ma. There is, therefore, no correlation between the coarse breccias below the Helen Iron Range and those north of the Magpie River.

A modification of the cycle one volcanism may explain the presence of only siderite in the Magpie Iron Range. The volcanic stratigraphy at the Magpie Mine is fundamentally identical to that below and above the Michipicoten-type iron formation stretching from the Helen Iron Range in Chabanel Township to the Josephine-Bartlett Iron Range in Corbiere Township. The onset of intermediate to felsic volcanism before the completion of siderite deposition could account for the separation of the carbonate facies of the Magpie Mine and development of both carbonate and younger facies higher in the stratigraphy which are represented by the Reynolds and Godon Lake iron ranges. The Magpie Mine volcanic centre is similar if not identical to the volcanic centre found at the Helen Iron Range.

Samples of feldspar crystal tuff from Abotossaway, Corbiere, and Leclaire townships were examined in thin section. The dominant texture is fine-grained seriate and granoblastic with curved to straight grain boundaries. The estimated mode is 10 to 50% altered plagioclase feldspar, 5 to 20% carbonate, 0 to 20% sericite, 0 to 15% chlorite, 0 to 10% quartz and a trace of opaques. The granoblastic matrix to the feldspar crystals was often too fine-grained for detailed optical study. The matrix generally consists of fine-grained quartz and untwinned plagioclase feldspar with minor sericite and carbonate.

The altered plagioclase grains are anhedral to euhedral, fractured, and generally too altered for composition determination.

North of the Magpie Mine a sample of massive felsic metavolcanic rocks interpreted to be a possible flow was thin sectioned. The rock consists of approximately 80% fine-grained granoblastic quartz plus untwinned plagioclase feldspar and 20% fine-grained sericite clots.

A sample of intermediate to felsic lapilli tuff from Sky Pilot Lake, Leclaire Township consisted of 85 to 90% fine-grained granoblastic quartz plus untwinned saussuritized plagioclase and 10 to 15% sericite.

A unit in the vicinity of the Magpie Mine mapped as a felsic flow contained up to 5% microphenocrysts of quartz and 1% microphenocrysts of plagioclase. Traces of biotite were present and 4 to 5% chlorite after possible mafic clasts was noted; the remainder of the specimen was a fine-grained granoblastic mosaic of quartz and untwinned plagioclase.

Three samples of the hard chert-like breccia lying below the siderite of the Magpie Iron Range were examined in thin section. The rocks contained 0 to 2% carbonate, 10 to 25% sericite, 1 to 20% amphibole, 0 to 10% quartz and 50 to 80% fine-grained, granoblastic matrix of quartz plus untwinned plagioclase. The low carbonate content and presence of amphibole indicate a slightly higher metamorphic grade than other samples studied.

A collection of clasts was made for chemical analysis from Iron Knob (local name) east of the Magpie Mine and from the breccia associated with the Alice Iron Range. A select group of clasts from this collection were examined in thin section. The mineralogy between clasts is highly variable. In general, over 70% of the clasts consist of very fine-grained granoblastic quartz and untwinned plagioclase. One clast contained up to 1% microphenocrysts of quartz. In one or more samples, biotite, chlorite, chloritoid, epidote, carbonate, opaque, amphibole and sericite were present in quantities less than 10%. Sericite may amount to an estimated 30% in some samples. Epidote exceeded 10% in one specimen.

One sample of enclosing breccia matrix was examined in thin section. In addition to the fine-grained granoblastic quartz plus untwinned plagioclase matrix, the matrix consisted of 15 to 20% euhedral magnetite, 10 to 15% chlorite and 5 to 20% sericite.

A sample of feldspar crystal tuff from the tuff band lying along the north side of a felsic intrusion north of Middleton Lake was examined in thin section. This sample consisted of 20 to 45% granoblastic quartz plus untwinned plagioclase, 20 to 25% carbonate, 5 to 10% sericite, 1 to 5% chlorite, and 30 to 40% plagioclase (An33?).

A relatively large sample population of intermediate to felsic metavolcanic rocks were analyzed for major and minor elements. Sampling was more difficult than in the area to the south (Sage 1987a) since apparent fresh unaltered rock was not as common. The intermediate to felsic volcanic rocks of this area were somewhat higher in chlorite content and visible quartz is rare. Apparently these field observations are reflected in rock chemistry since more intermediate compositions are indicated on AFM and cation plots of rock chemistry (Figures 6 and 7). The intermediate to felsic metavolcanic rocks do not display as strong clustering and as strong a bimodal nature as the ones in the area to the south (Sage 1987a). Surfical mapping suggests that the volume of intermediate to felsic metavolcanic rocks is considerable. The generation of such large volumes of intermediate to felsic metavolcanic rocks would likely require the involvement of processes other than simple crystal fractionation.

Intermediate to felsic metavolcanic rocks are uncommon in Dunphy Township. Intermediate to felsic tuffs and breccias are exposed in several railroad rock cuts along the Algoma Central Railway and a small area of intermediate to felsic tuff occurs in the southern part of the township not far from the border with Abotossaway Township.

Intermediate to felsic rocks in Dunphy Township weather buff, white, grey, and rarely pale pink. On fresh surface, they are pink, greenish pink, brown, pinkish brown, pink, and grey.

A thin section was prepared from the tuff located in the southern part of Dunphy Township. The tuff displayed a fine-grained seriate granoblastic texture with curved grain boundaries. The rock was composed of an estimated 10% sericite and the remainder is a mosaic of interlocking anhedral grains of quartz and untwinned plagioclase. The schistosity in the rock was a function of the preferred orientation of the mica grains.

Domains of quartz and untwinned plagioclase sitting in a much finer-grained mosaic of quartz and untwinned plagioclase, may represent the outline of former clasts.

The tuff unit in the southern portion of the township had a thin 2 to 4 m wide unit of chert-magnetite-wacke iron formation along its north side.

The presence of this minor unit of felsic tuff was previously indicated by Bruce (1940). These very minor intermediate to felsic metavolcanic units found in Dunphy Township are interpreted to be part of cycle two volcanism.

METASEDIMENTARY ROCKS (MAP UNIT 4)

Metasedimentary rocks are present at Parks Lake in southwestern Corbiere Township, in a long continuous band stretching from south central Corbiere Township to the northwestern part of Leclaire Township, in the southwestern corner of Musquash Township, and as a continuous band along the northern edge of Leclaire and Abotossaway townships.

Metasedimentary rocks rock in the area are found on the west side of Parks Lake. This sequence of sedimentary rocks is the eastern extension of the metasedimentary rocks found above the Ruth Iron Range in Esquega Township (Sage 1987a). These metasedimentary rocks have been mapped and interpreted by Neale (1981) and Thomas (1984). These metasedimentary rocks can be traced westward to Lake Superior across a number of northwest-trending transverse faults where they were described by Collins and Quirke (1926) and by Massey (1985).

On the west side of Parks Lake, well exposed laminated to thin bedded siltstone and mudstone are present. A spectacular set of fracture cleavages cut the bedding at 035 to 045 and dip steeply south and north. Fold axes of minor folds trend 010 to 015 and plunge steeply northeast and southeast. The laminated to thin bedded siltstones and mudstones rapidly decrease in volume westward and a thick sequence of subarkose to wacke is present. The wacke varies from thin to thick bedded, displays well developed cross-bedding up to 1 m or more in size and rarely crude ripple marks can be found on bedding planes. Several thin bands of pebble conglomerate were noted.

At the western limit of the metasedimentary rocks, near an unnamed lake west of Parks Lake, pebble and cobble conglomerate is present along the contact with massive and pillowed intermediate to mafic metavolcanic rocks. This conglomerate is unstratified, matrix supported, and contains clasts of a wide variety of supracrustal rocks in a volcanic tuff matrix. To the northeast, the metasedimentary rocks interfinger with pillowed and massive metavolcanic rocks. Strike-slip shearing is common in this area. This interfingering is interpreted by the author to represent a largely tectonic feature due to thrusting and not necessarily a primary depositional relationship. Facing data from cross-bedding suggest a north-facing sequence and both grain gradation and cross-bedding give opposite facing directions; north and near the unnamed lake to the west and close to the contact with intermediate to mafic metavolcanic rocks. Tight, isoclinal folding is present in the upper portion of the metasedimentary rock stratigraphy. On the basis of cross-bedding relations in wacke, the transport direction of the sedimentary rocks may be from west to east.

A specimen of wacke-siltstone and a coarse sandstone were examined in thin section. The sandstone is comprised of detrital quartz as angular fractured grains in quantities up to 35% and angular fractured grains of plagioclase up to 45% with sericite, chlorite, and carbonate making up the remainder of the samples. The mineralogy of the finer grained siltstone and mudstone is more difficult to determine. The finer grained metasedimentary rock consists of 15 to 20% quartz, 30 to 35% sericite, 30 to 35% chlorite, up to 10% carbonate and up to 10% fine-grained opaques.

The larger quartz grains have a wavy extinction and some of the finer-grained interstitial quartz may have originally been authigenic but recrystallization prevents a definitive interpretation. Carbonate occurs as large anhedral to subhedral porphyroblasts in the wacke-siltstone. The opaques may represent a mafic mineral subsequently replaced by limonite.

Four samples of the buff weathering cross-bedded wackes from the Parks Lake area were chemically analyzed. These four samples were plotted on AFM and cation diagrams (Figures 8 and 9). The data points suggest that they are more iron rich than most intermediate to felsic metavolcanic rocks which is likely a function of the presence of chlorite. There is an over lap of metasedimentary compositions with intermediate to felsic metavolcanic compositions, a relationship that can be anticipated due to the interfingering of metavolcanic and metasedimentary rocks.

The metasedimentary rocks are largely derived from intermediate to felsic metavolcanic rocks of cycle two volcanism and the interfingering of cycle two intermediate to felsic metavolcanic rocks and metasedimentary rocks is well displayed in Chabanel Township (Sage 1987a). The chlorite may represent an addition of fine-grained mafic detritus from the intermediate to mafic metavolcanic platform on which the felsic rocks were deposited. On weathered surface, these rocks characteristically appear as arkose but on fresh surface the chlorite content is of sufficient volume that the cross-bedded rocks have a distinctive light to medium green colour. The presence of significant chlorite content has prompted the author to classify the buff weathering cross-bedded sequences as wackes or subarkoses. The metasedimentary band stretching from south-central Corbiere Township to northwestern Leclaire Township has been cut off to the east by the Marsden Fault east of Kilkenny Lake. The rocks in the vicinity of Kilkenny Lake appear similar to those west of Parks Lake. The rocks consist of cross-bedded and bedded wacke with minor siltstone and mudstone. The metasedimentary rocks east of Kilkenny Lake locally display considerable deformation and facing directions are often difficult to determine or are conflicting. Cross-bedding relationships indicate they dominantly face north.

The second area of extensive development of metasedimentary rocks occurs northwest of Kilkenny Lake to East Andre Lake, where the amount of wacke decreases and the amount of mudstone and siltstone increases. On the basis of cross-bedding relations in the metasedimentary rocks northwest of Kilkenny and Kimbell lakes and grain gradation in coarser wacke beds farther westward, the metasedimentary rocks face south. The Magpie River Fault separates the north facing metasedimentary rocks at Kilkenny Lake from the south facing metasedimentary rocks that extend northwest and beyond East Andre Lake. The metasedimentary rocks at East and West Andre lakes are part of a continuous band of metasedimentary rock from south-central Corbiere to northwestern LeClaire townships.

At West Andre Lake, the Bauldry Lake and Goetz Lake faults join and the sedimentary rocks are sharply folded and thickened. This folding is indicated by reversals in facing directions determined in graded beds (Plate 5). Northwest of West Andre Lake, isolated facing data using grain size gradation in wacke beds suggests a south facing stratigraphy.

At West Andre Lake, thin-bedded siltstone and mudstone exceed the wacke in abundance. On the east side of West Andre Lake, excellent graded bedding occurs in resedimented intermediate to felsic tuffs (Plate 6). Fragments of intermediate to felsic metavolcanic rocks are pebble size in some beds. The coarser sedimentary rocks display a tendency to be thicker bedded.

At the Magpie River, the metasedimentary rocks are dominantly siltstone and mudstone. Grain gradations in the coarser beds gave opposing facing directions suggesting minor folding in this area.

Between the Magpie River and Ireland Lake reliable facing data is scarce and the dominant rock types are siltstone and mudstone. Grain gradations in the Punk Lake area and on a small lake east of Clearview Lake indicate the metasedimentary rocks face south. From Ireland Lake the metasedimentary rocks take a turn northward to Kapimchigama Lake. Between Ireland Lake to Kapimchigama Lake, the quantity of wacke to subarkose appears to increase. The metasedimentary rocks at Kapimchigama Lake are deformed and facing data is conflicting possibly due to folding. The stratigraphic section faces south on the basis of mapping which is consistent with the facing data at Ireland Lake and with the pillows within intermediate to mafic metavolcanic rocks to the east. The metasedimentary rocks extend westward from Kapimchigama Lake to outside the map area.

Conglomerate is rare in the metasedimentary rocks that extend from Kilkenny Lake in Corbiere Township to Kapimchigama Lake in Leclaire Township. Pebble conglomerate was observed on west Andre Lake, cobble and pebble conglomerate was noted near an unnamed lake northwest of West Andre Lake, and a pebble conglomerate is present on the north side of the metasedimentary band where it intersects the Magpie River. One outcrop of pebble to cobble conglomerate was noted on an island in Ireland Lake. The conglomerates are matrix supported, lack well-developed bedding and do not contain recognizable granitic clasts.

Thin sections were prepared of samples from the coarser grained wacke beds found in the metasedimentary bands found between south central Corbiere and northwestern LeClaire townships. The rocks are fine- to medium-grained seriate with a granoblastic texture. The metasedimentary rocks have been recrystallized but appear petrographically as sandstones.

The abundance and angularity of the feldspar grains, angularity of quartz grains and presence of chlorite-rich matrix all support immature sandstones. The author interprets the bulk of the Dore-type metasedimentary rocks to result from the reworking of intermediate to felsic pyroclastic deposits of cycle two volcanism with which the metasedimentary rocks interfinger (Sage 1987a). A similar interpretation is proposed by Ojakanjas (1983, 1985), who also found volcanic lithic debris in his samples.

The mode varies widely between samples. The mode is estimated to be 5 to 40% quartz, 0 to 10% chert, 0 to 15% carbonate, 0 to 55% chlorite, 0 to 70% plagioclase (An2 to 10) and trace of opaques. Some samples have a matrix that is too fine grained to estimate mode. This fine-grained, granoblastic matrix reached a maximum of 75% in one mudstone sample.

The quartz is present as angular anhedral to rounded grains. Occasional chert fragments are a very fine-grained, rounded to subangular, polycrystalline aggregate. The plagioclase occurs as highly altered, angular to euhedral crystals and crystal fragments. The plagioclase is extensively saussuritized. The carbonate occurs as anhedral disseminated grains. The chlorite and sericite occur throughout the rock as fine-grained fibrous or micaceous grains.

In the southwestern corner of Musquash Township, a third area of metasedimentary rocks interfinger with intermediate to felsic metavolcanic rocks of cycle two volcanism. These metasedimentary rocks consist of wacke, arkose, siltstone, argillite and mudstone. Bedding is locally present. Wacke is by far the dominant metasedimentary rock. Thin sections of these metasedimentary rocks were not prepared.

Along the northern margin of Leclaire, Dunphy and Abotossaway townships a broad zone of metasedimentary rock (approximately 0.8 km wide) separates the metavolcanic rocks from the external granitic rocks that enclose the Wawa supracrustal rocks. This fourth major area of metasedimentary rocks are very poorly exposed with most outcrops being small and widely spaced. These metasedimentary rock units appear to be identical to the Dore metasedimentary rocks described by Collins and Quirke (1926). The lower contact between the metasedimentary rocks and the metavolcanic rocks is difficult to position, as was noted by Bruce (1940). Close to the contact, the intermediate to mafic metavolcanic rocks are bedded tuffs and it is difficult to ascertain in many cases whether volcanic or sedimentalogical processes were dominant in a given exposure.

Primary sedimentary structures other than bedding are generally absent in this wide band of metasedimentary rock. At the contact metasedimentary-external granitic rock contact, the metasedimentary rocks are regionally metamorphosed from upper greenschist to lower amphibolite rank.

Dore-type conglomerate was observed along the access road to Tray Lake in northern Leclaire Township. Granitic boulders up to 1 m in maximum dimension were observed in this area. The boulders were highly deformed and lensoid in cross section. The deformation of the granitic boulders and cobbles was much greater than similar appearing clasts in road cut outcrops along Highway 17 north of Wawa. Boulders and cobbles of granitic composition in the Highway 17 exposure are relatively undeformed in contrast to extensive deformation of the associated volcanic clasts. In the Tray Lake exposures, former volcanic clasts have been largely obliterated due to deformation and the granitic boulders are typically lensoid in cross section.

Several outcrops of conglomerate without obvious granitic clasts are also present in northeastern Leclaire Township.

In north central Abotossaway Township, one good outcrop of Dore-type conglomerate was found in association with wacke metasedimentary rocks.

The conglomerates are probably lensoid bodies in plan view and are not likely a continuous unit.

In thin section, the wackes within Leclaire and Abotossaway townships display a fine-grained equigranular or porphyroblastic-seriate, granoblastic texture with straight to curved grain boundaries. The mode is estimated as biotite 15 to 40%, quartz 35 to 40%, untwinned plagioclase 20 to 60%, epidote 0 to 10%, amphibole 0 to 20%, with minor to trace amounts of carbonate, sericite, sphene and magnetite.

The biotite forms tabular anhedral grains whose preferred orientation imparts a schistosity to the rock. The quartz is anhedral and interlocked with untwinned plagioclase providing the granoblastic texture to the rock. The epidote forms tiny anhedral grains scattered throughout the rock. Locally several grains cluster together. Hornblende is present in one sample as both large porphyroblastic grains and smaller grains throughout the rock.

North of the greenschist facies, in the center of the metasedimentary rock sequence, biotite becomes abundant and amphibole makes its appearance close to the supracrustal granitic contact.

One thin section was prepared from a granitic boulder from the Dore-type conglomerates exposed along the access road to Tray Lake. The original texture was probably medium-grained equigranular hypidiomorphic. The quartz is now recrystallized and polycrystalline and the margins of the plagioclase lobate. The mode was estimated as 30 to 35% quartz, 5 to 10% biotite, 60 to 70% plagioclase (An6) and less than 5% potassium feldspar.

The biotite forms tabular, subhedral to euhedral grains interstitial to quartz plus plagioclase. The grains are more or less random in orientation. The plagioclase is turbid and saussuritized. The alteration of the core of the grains is greater than the margin and the relationship may suggest an original compositional zoning of the plagioclase. Locally some plagioclase crystals display bent albite twin planes suggesting some deformation. The quartz consists of anhedral interlocking grains interstitial to the plagioclase. The potassium feldspar forms large anhedral crystals that are only moderately saussuritized and do not display evidence of deformation.

A thin section of the matrix to a Dore-type conglomerate indicated a fine-grained seriate granoblastic texture with curved grain boundaries. The mode is estimated at 30% quartz, 50 to 60% plagioclase (An8), 20 to 25% biotite. Accessory epidote, carbonate, and sericite were present.

Biotite occurs as tabular anhedral to subhedral grains which define a schistosity. The quartz forms anhedral interlocking grains with plagioclase. The larger quartz grains have wavy extinction. Plagioclase occurs as anhedral twinned and untwinned grains interlocking with quartz. The larger plagioclase grains are dusted with saussurite alteration.

The metasedimentary rocks along the north flank of the Michipicoten supracrustal rocks in contact with the external granitic rocks are well exposed in parts of Dunphy Township. Logging operations have permitted a close examination of the metasedimentary rocks in areas that formerly would be difficult to access.

The metasedimentary rocks are almost exclusively wacke, even though some of the thin individual beds may approach subarkose. The metasedimentary rock are thin bedded and within any given exposure the bedding is uniform and continuous across the outcrop. Individual beds vary from less than 1 cm to approximately 5 cm in thickness. The metasedimentary rocks are generally composed of silt size particles with clay and sand size material being much less common. On the basis of grain size, siltstone is a dominant rock type.

A unit of Dore-type conglomerate occurs 0.8 km east of an unnamed lake and approximately 3.2 km north of the Dunphy-Abotossaway Township boundary near the western limit of the supracrustal rocks in Dunphy Township. The conglomerate is a massive unit wedged between thin bedded wacke (Plate 7). In plan view, it appears lensoid. Granitic cobbles and boulders up to 0.3 m in diameter are present and they are shaped like curling stones. The granitic cobbles and boulders are trondhjemite to quartz diorite in composition, medium-grained, and massive. The cobbles weather buff to grey and stand in relief above the biotite, quartz-plagioclase (wacke) schist matrix. The conglomerate occurs within the metasedimentary section, neither close to the top nor to the base. There are no recognizable primary depositional features, such as bedding, in the conglomerate unit. This outcrop of Dore-type conglomerate would appear to lie on patented claim number 1600.

The thin bedded metasedimentary rocks contain increasing amounts of amphibole near the contact with the external granitic rocks are approached. This feature is likely a contact metamorphic effect in response to emplacement of the younger external granitic rocks.

Primary structures useful for interpreting depositional environment or stratigraphic facing directions were rare to very rare. With the exception of several occurrences of graded bedding primary structures were not observed. While the facing direction as determined by grain gradations is somewhat conflicting the most reliable readings based on the best developed grain gradations indicate a north facing stratigraphy. The metasedimentary rocks therefore, face towards the external granites and are in agreement with facing data obtained within the metavolcanic rocks.

In thin section, the metasedimentary rocks are fine-grained, equigranular, allotriomorphic and granoblastic with curved to straight grain boundaries. The mode is estimated to be sericite 0 to 15%, biotite 6 to 40%, actinolite 0 to 15%, and quartz plus untwinned plagioclase 60 to 75%. Minor quantities of sphene, chlorite, carbonate, opaque and epidote were noted in a number of samples.

Sericite occurs as tiny anhedral grains and as large poikiloblastic grains enclosing quartz and plagioclase. The biotite occurs as anhedral tabular grains. The biotite is the dominant mineral imparting a schistosity to the rock. Chlorite alteration of some biotite was observed suggesting retrograding of the biotite. Acicular actinolite was present in several samples The actinolite is pleochroic in green and elongated in the plane of the schistosity.

The matrix is composed of an interlocking mosaic of granoblastic plagioclase and quartz. The grain boundaries are curved to straight and most plagioclase is untwinned. Compositions determined on rare grains displaying albite twinning indicate a sodic composition of approximately An 38.

In a number of outcrops, bright red garnet porphyroblasts were observed but not examined in thin section. The garnet crystals were euhedral, composed up to 40% of a bed, and restricted to individual beds. The presence of garnet in discrete beds implies that only certain rare or uncommon beds had the appropriate composition to form garnet under the metamorphic conditions that once existed. The garnet that was observed occurred approximately 1 km south of the supracrustal-granitic contact and it is uncertain whether it developed in response to regional or contact metamorphic conditions.

Bruce (1940) reported the plagioclase in the Dore-type metasedimentary rocks to be a basic oligoclase and that an associated pale green amphibole has a sieve texture and is associated with a small amount of garnet. He reported the presence of sericite. The mineralogy of a sample examined by Bruce (1940) is indicative of a higher metamorphic grade than samples examined by the author.

Minor metasedimentary units occur in several areas of the map area. Most do not warrant detailed study. At Sheldon Lake, a minor unit of wacke, siltstone, and mudstone occurs in proximity to the Sheldon Lake Iron Range. One outcrop of conglomerate consisting of volcanic clasts is present. Thin bedded metasedimentary rocks strike 270 to 300°, and display a pronounced fracture cleavage at approximately 230 to 250° to the bedding. This cleavage dips steeply north. Kink bands subparallel to the fracture cleavage locally cut the metasedimentary rocks.

Two thin sections were prepared from the wacke beds. In thin section, the immature sandstones display a fine-grained, equigranular, granoblastic texture with straight to curved grain boundaries. The mode is estimated as 5 to 15% quartz, 0 to 20% angular altered plagioclase, 0 to 20% carbonate and 55 to 85% fine-grained matrix. The matrix consists of a granoblastic mixture of quartz and untwinned plagioclase with chlorite, carbonate, and sericite.

Quartz and carbonate occupied fractures in the rock and fine-grained anhedral carbonate occurs throughout the metasedimentary rock. Recognizable detrital quartz grains are rounded to subangular in outline.

FERRUGINOUS DOLOMITE

A distinctive rusty brown weathering carbonate unit occurs above the mafic breccia at the top of the massive to pillowed rocks of cycle one and below the intermediate to felsic metavolcanic rocks. This unit has been traced from Parks Lake in the southwest corner of Corbiere Township to Siderite Lake in southeastern Corbiere Township. The unit occurs below the Ruth Iron Range in adjacent Esquega Township from where it extends from the

Ruth Iron Range to the east end of the Josephine-Bartlett Iron Range (Sage 1987a). This carbonate unit forms a marker horizon.

At Parks Lake, this carbonate unit faces north and forms the north face of a large ridge at the southern end of Parks Lake. At this location, the carbonate unit is crisscrossed by a network of milky quartz veins. These veins make for easy recognition of this unit in the field.

At Siderite Lake, the carbonate horizon lacks a network of quartz veins and forms a 30 m high cliff face of fine-grained carbonate. There is a sharp contact between the carbonate and a overlying laminated to thin-bedded intermediate to felsic tuff to the north. The carbonate unit has a subvertical dip and while it likely pinches and swells along strike, its maximum width is estimated to be approximately 30 m.

In thin section, the rock is very fine-grained, massive, allotriomorphic and granoblastic with lobate grain boundaries.

The mode is estimated to be 70 to 80% carbonate and 20 to 30% quartz. Traces of iron oxide staining are present.

The quartz occupying the fractures is polycrystalline and much coarser grained than that interlocking with the carbonate. The carbonate displays a slight increase in grain size next to the quartz veins.

IRON FORMATION (MAP UNIT 5)

Iron formation is abundant in the map area. Hematite was produced from the Josephine Iron Range and siderite was produced from the Magpie Iron Range. Prospecting has taken place on nearly all the iron ranges.

The best developed iron ranges are the Josephine West Extension, Josephine, and Josephine-Bartlett in southern Corbiere Township. These three ranges are in fact one and the same with different names being applied to different sections of a continuous unit. For most of its strike length, the range is a typical Michipicoten-type iron formation with a siderite bottom and chert top. At Parks Lake, hematite occupies the stratigraphic position of the siderite at the bottom of the iron formation. This hematite occurs at the intersection of the Magpie River and Josephine faults which permitted the deep circulation of ground water that altered the siderite to hematite. The author interprets the hematite to be an alteration of the original siderite by the deep circulation of ground water and not of hydrothermal fluids as proposed by Brown and Morrison (1942).

The Josephine West Extension is the faulted eastern extension of the Ruth Iron Range. Left-lateral offset along the Goetz Lake Fault that separates these two iron ranges is approximately 833 m. Between the Goetz Lake and the Marsden faults, the iron formation is relatively continuous. The Josephine Fault, while important in forming the Josephine hematite deposit, shows relatively minor movement. The Josephine Fault has an estimated left lateral offset of 25 m at the south end of Parks Lake. Moore and Armstrong (1946) reported an offset of 20 m at Endless Lake just north of Parks Lake.

The Michipicoten-type iron formation consists of at least five facies which from bottom to top are carbonate, sulphide, chert-magnetite-wacke, chert-wacke, and argillite-graphite-pyrite. A full description of the Michipicoten-type iron formation was prepared by Sage (1987a). The work by Hawley (1942a) on the replacement origin of the Rand No.2 Iron Range Abotossaway Township is also summarized by Sage (1987a).

There is some disagreement as to the eastern extension of the Josephine-Bartlett Iron Range across the Marsden Fault. The author correlates the eastern end of the Josephine-Bartlett Iron Range with the Central Brooks Iron Range, however, Richter (1952) and Goodwin (1962) correlated the eastern end of the Josephine-Bartlett Iron Range with the East Brooks Iron Range, which lies east of the Marsden Fault. The author interprets the Central Brooks Iron Range to be the in-folded extension of the Josephine-Bartlett Iron Range which became detached during formation of the Centre Anticline.

From the Central Brooks Iron Range the Michipicoten-type iron formation is represented by the West Brooks Iron Range, Reynolds Iron Range, Magpie Mine Iron Range, Alice Iron Range, Godon Lake Iron Range, and South Evans Creek Iron Range. Scattered thin remnants of iron formation north and west of Eccles Lake (local name), Abotossaway Township may also be remnants of Michipicoten-type iron formation even though the carbonate facies has not been found associated with these them. The South Evans Creek Iron Range would then be correlated with the East Brooks Iron Range. The East Brooks, Sheldon Lake, Big Lake, Reau-Mary lakes, Cline Lake and Rand No.2 iron ranges are representative of Michipicoten-type iron formation. Airborne geophysical records indicate that Michipicoten iron formation likely occurs between the Reau-Mary lakes and Rand No.2 iron ranges at the intermediate to mafic-intermediate to felsic metavolcanic rock contact (AFRO). All facies of iron formation may not be present at any one location. The carbonate facies is most elusive having been observed by the author in outcrop only at the Magpie Iron Range and the Rand No.2 Iron Range.

The details of each iron range will be given in the property description section of this report.

The Magpie and Alice iron ranges are unique since they consist almost exclusively of the carbonate facies, or its metamorphosed equivalent, of the Michipicoten iron formation. The presence of coarse felsic breccias on the south and west sides of these ranges and the presence of intermediate to mafic metavolcanic rocks on the north and east sides suggests a north- to east-facing of the Alice and Magpie iron ranges when compared to other stratigraphic sections observed in the area. One possible interpretation to explain the carbonate-only facies of iron formation at the Magpie Iron Range is that mafic volcanism occurred before siderite deposition was completed. This volcanism would conceivably have separated the siderite facies of the Magpie and Alice Iron Range from the stratigraphically higher facies found at the Reynolds Iron Range if iron formation deposition continued in sequential manner after this short burst of volcanic activity. A second interpretation is that the thrusting has split the iron formation and repeated the stratigraphy prior to regional folding.

Another major unit of iron formation occurs in the northern part of Leclaire and Abotossaway townships. This iron formation is composed of chert and magnetite with minor pyrite and is known as the North Evans Creek Iron Range in Leclaire Township. In Abotossaway Township, the likely eastern extension of this iron range has little exposure but its presence is indicated on airborne geophysical maps (AFRO). In Dunphy Township, the on-strike continuation at this iron formation is referred to as the Dreany Iron Range.

The chert-magnetite iron formation is often poorly exposed and is often represented in outcrop by iron stained sugary quartz. A sample from the North Evans Creek Iron Range was examined in thin section. Carbonate is present as fine-grained anhedral crystals throughout the slide. The quartz in the chert-rich bands is coarser grained than the quartz in adjacent magnetite-rich bands. The magnetite occurs as subhedral grains of similar size in all the bands.

In the chert layers, needle-like crystals stained brown and with high relief were noted. The crystals are too small for positive identification, but could be grunerite, for it has been reported from the Brandt Lake Iron Range (Collins and Quirke 1926) immediately west of the map area. The Brandt Lake Iron Range is stratigraphically equivalent to the Dreany and North Evans Creek iron ranges.

In the Mishewawa area, south of Wawa, Massey (1985) reported the presence of radiating spheroids of grunerite in sandy chert layers with low magnetite content. The grunerite in that area is concentrated along laminae or beds and weathers high (Massey 1985).

Iron formation within Dunphy Township consists of thin bedded chert and magnetite. Trace or very minor pyrite may be present and there is no evidence indicating the presence of a carbonate facies. The quartz beds are granular or sucrosic and buff, grey or white in colour. The magnetite-rich beds are grey to black. Individual beds vary from less than 1 cm in width to 4 to 5 cm. Folding or primary soft sediment slump structures are generally absent and bedding relatively uniform across the outcrop. While the magnetite or iron content is generally low, it does occur in sufficient quantities to cause severe compass deviations when traversing the area.

The main unit of chert-magnetite iron formation lies dominantly within Dore-type metasedimentary rocks along the northern margin of the supracrustal sequence. Collins and Quirke (1926) stated that the Dreany Iron Range lies within mafic metavolcanic rocks. Although, the eastern portion of the range northwest of Alexandra Lake in Dunphy Township does appear to lie within tufaceous mafic metavolcanic rocks, most of the range lies within wacke metasedimentary rocks. The Dreany Iron Range is continuous but offset by left-lateral faulting in at least four places in Dunphy Township. Aeromagnetic and electromagnetic maps indicate that the Dreany Iron Range, while offset by faulting, is relatively continuous across Dunphy Township (AFRO). Other occurrences of banded chert-magnetite iron formation are much more limited in strike length and of a much more local nature.

The main Dreany Iron Range in Dunphy Township reaches widths of 45 m or more and are stratigraphically equivalent to similar units in Abotossaway Township Finan Township (Sage 1987c).

Collins and Quirke (1926) reported the presence of a lenticular bed of magnetite of 4 feet in width in the Dreany Iron Range but the author has not observed a magnetite band of this width.

The Dreany Iron Range is not like the Michipicoten-type iron formation since it does not have a sulphide or carbonate facies and does not occur at the contact between felsic and mafic volcanism. While the iron formation lies dominantly within Dore-type metasedimentary rocks, mapping suggests that locally it lies within intermediate to mafic metavolcanic rocks dominantly of a tufaceous nature. If the Dreany Iron Range is a time equivalent unit, it may transgress the stratigraphy. The metavolcanic-metasedimentary rocks hosting the Dreany Iron Range contrast with the volcanic stratigraphy above and below the Michipicoten-type iron formation implying different origins for the two iron formations. Sedimentary processes may have dominated during Dreany Iron Range deposition and volcanic-fumarolic processes dominated during the Michipicoten Iron Formation deposition. Bruce (1940) recognized the fundamental lithologic differences between the Dreany Iron Range and Michipicoten-type iron formation.

Collins and Quirke (1926) reported the presence of epidote, grunerite, and garnet within the Dreany Iron Range. The local presence of a yellow-green tint to the iron formation suggests epidote is locally present and possible grunerite was identified from Dreany Iron Range samples collected in Leclaire Township. The presence of garnet was not confirmed in thin section.

Numerous small apparently discontinuous segments of iron formation have been encountered in mapping. They are most common in west central Corbiere Township. They consist of chert, magnetite, and pyrite. They may be the segmented remains of a more continuous iron formation unit or may be thin interflow chemical sedimentary rocks.

Numerous small segments of chert-magnetite iron formation with subordinate pyrite occur near Mall Lake, Abotossaway Township. These small units are commonly highly folded which may represent primary slump structures overprinted by tectonic deformation since the folded iron formation displays some evidence of later brecciation. These minor iron formations are thought to have been deposited during periods of interflow chemical sedimentation.

MAFIC INTRUSIVE ROCKS (MAP UNIT 6)

Mafic intrusions of various sizes and shapes are common in the map area. The identification of a mafic intrusion within intermediate to felsic metavolcanic rocks is based on contact relations and absence of any preserved primary structures indicative of an extrusive origin. The identification of a mafic intrusion within intermediate to mafic metavolcanic is largely based on grain size. Massive intermediate to mafic outcrops of medium- to coarse-grained size were mapped as mafic intrusions. The use of grain size to subdivide the intrusive and extrusive rocks of intermediate to mafic composition is unsatisfactory but other criteria such as contact relations are generally not observable in the field or if observable are ambiguous in interpretation. Bruce (1940) also ran into difficulty in subdividing the intermediate to mafic intrusions from the intermediate to mafic metavolcanic rocks.

Mafic to ultramafic intrusive rocks were generally not encountered in mapping the map area. A small body of metapyroxenite occurs at the eastern end of Endless Lake, Corbiere Township and has been mentioned in a previous report (Sage 1987a). This body is found within the Magpie River Fault Zone. It is the smallest of several ultramafic intrusions emplaced into this zone (Sage 1987a). In outcrop, the intrusion weathers black and is pitted and upon breaking displays large poikiloblastic biotite grains up to 1.5 cm in diameter.

In thin section, the mode is estimated to be actinolite 40%, chloritized biotite 20%, 30% plagioclase, 5 to 10% carbonate, and trace of apatite.

The actinolite forms an interlocking mass of acicular crystals. The large crystals of chloritized biotite are strongly kink banded and actinolite needles project into the altered biotite. The plagioclase appears to have been interstitial and is heavily dusted with poikilitic amphibole inclusions. Carbonate occurs as large anhedral grains with bent rhombohedral twin planes. One large apatite grain was fractured and veined with carbonate.

The mafic intrusive rocks of diorite, gabbro and quartz diorite composition weather grey, greenish black, black, and green. They vary from fine- to coarse-grained and locally are highly sheared and schistose and pervasively impregnated with carbonate.

Carbonate is almost ubiquitous in all mafic intrusions however some intrusions, particularly in Corbiere Township, have been pervasively impregnated and replaced by carbonate. The intrusions that are most pervasively impregnated with carbonate are commonly narrow dike-like appendages of large intrusive masses or the sheared margins along the contact of large intrusive masses and wall rocks. The smaller intrusions and the margins of the larger bodies may have been more receptive to metamorphisms during deformation. These rocks may consist of 40 to 50% rusty brown carbonate and have a thick weathered rim that may approach a width of 1 cm. The carbonate may occur as anhedral grains or as euhedral orange-brown rhombi up to 2 mm in maximum dimension. The euhedral crystals are interpreted to be porphyroblastic carbonate. Porphyroblastic carbonate has also been observed to occur within both the metasedimentary rocks and intermediate to mafic intrusions of Chabanel Township (Sage 1987a).

The gabbros, diorites, and quartz diorites appear to be gradational into each other. Quartz diorite is common in Corbiere and Abotossaway townships. The best example of quartz diorite lies north and south of Kozak Lake and south of the Rand No.2 Iron Range in Abotossaway Township. Outcrops of this quartz bearing mafic intrusive rock are common in rock cuts of the Algoma Central Railway. The quartz diorite is often fine- to medium-grained and characteristically contains a pale to very dark blue, fine-grained opalescent quartz. The fine-grained quartz can be easily missed if the rock is not examined with a hand lens. Moistening the surface with water before examination often helps in finding the quartz.

In thin section, the intermediate to mafic intrusive rocks were likely originally fine- to coarse-grained, massive, equigranular and hypidiomorphic. The original texture is only rarely preserved as the mineralogy is now exclusively of metamorphic origin.

The mode is estimated as quartz 0 to 15%, amphibole 0 to 95%, chlorite 5 to 40%, plagioclase 0 to 35%, opaque 0 to 15%, and carbonate 0 to 40%. Minor to trace amounts of epidote, sericite, and sphene were noted. In some rocks, the mineralogy was too fine-grained for optical identification.

The quartz is fine-grained, disseminated and polycrystalline. Some quartz appears crushed and fractured. One specimen contained granophyric quartz interpreted to be of primary origin since it lacks polygonalization typical of metamorphic recrystallization. This granophyre enclosed completely altered euhedral plagioclase. Most quartz is likely a product of alteration during metamorphism.

The amphibole is acicular actinolite that appears to replace a clinopyroxene. Relict twinning of the clinopyroxene may still be observable. The former clinopyroxene fills the interstices between the altered remains of plagioclase.

Chlorite is after amphibole is very fine-grained. Some chlorite appears to replace plagioclase. The chlorite is not always evenly distributed throughout a rock and may occur in chlorite-rich clots.

Plagioclase is almost always totally saussuritized. Euhedral crystal outlines of the altered plagioclase may be apparent in some samples and gives the only clue to a former hypidiomorphic texture. In other samples, the plagioclase is anhedral interstitial. Relict albite twinning is present on plagioclase in some samples and in some samples the former plagioclase is enclosed in former clinopyroxene indicating a former ophitic texture. One sample contained relict, unaltered plagioclase which upon optical examination suggests a composition of An_{33}.

Opaques are almost exclusively Fe-Ti oxides, though traces of pyrite may be present. The Fe-Ti oxides are generally altered to leucoxene but unaltered Fe-Ti oxide cores to the leucoxene grains can occur. If the Fe-Ti oxides are fresh they tend to be fine-grained, anhedral and disseminated. In one sample, the Fe-Ti oxides were skeletal and morphologically of primary origin. At least some of the fine-grained Fe-Ti oxides are likely the product of metamorphic alteration of the primary mineralogy.

Carbonate may be present as fine-grained, anhedral grains scattered throughout or, in those samples rich in carbonate, as large anhedral to euhedral porphyroblastic grains.

The fine-grained matrix that characterizes several specimens appears to be a mixture of chlorite, epidote, quartz and untwinned plagioclase. The fine-grained matrix is granoblastic.

Mapping suggests the presence of opalescent blue quartz indicates an intrusive rock. Previous mappers assumed an extrusive origin and mapped these rocks as latitic greenstone (Collins 1918; Thompson 1926). Collins (1918) indicated that a composition for his latitic greenstone was equivalent to a quartz diorite, a name applied to the rock by the author. Primary textures indicating an extrusive origin in the fine-grained, massive mafic rocks containing blue opalescent quartz were not observed.

A limited number of intermediate to mafic intrusive rocks were submitted for complete rock chemistry and the results are on displayed on Figures 10 and 11.

An AFM plot indicates that the intrusive rocks plot as the equivalent of high iron tholeiites. On the cation plot (Figure 11), the data indicate two distinct clusters. One cluster is equivalent to high iron tholeiite and the other to basaltic komatiite. The mafic intrusive samples representing the equivalent of high iron tholeiites were from the area west and north of Kozak Lake in Abotossaway Township and the basaltic komatiitic rocks are representative of the mafic intrusions northeast of Finger (Cline) Lake in Corbiere Township.

On the basis of field mapping, only one suite of mafic intrusions was identified. The chemical data indicate two suites of different chemistry might be present. The rocks west and north of Kozak Lake were mapped as dominantly quartz diorites and are essentially equivalent in composition to intermediate to mafic metavolcanic rocks. Volcanic rocks possibly related to these quartz diorite intrusions would have to be the intermediate to mafic metavolcanic rocks of cycle two or younger since the intrusive rocks cut intermediate to felsic metavolcanic rocks of the upper portion of cycle one. The basaltic komatiite equivalent mafic intrusive rocks mapped as gabbros and diorite east of Finger (Cline) Lake do not have a known extrusive equivalent on the basis of present sampling. The mafic intrusive rocks at Kozak Lake contain visible quartz and are finer grained than the visible quartz-free rocks east of Finger Lake. These field observations may reflect their contrasting chemistries.

The small peridotite intrusion at the east end of Endless Lake is equivalent to basaltic komatiite in composition. Additional information on this group of intrusions, which is more dominant in the adjoining area, is given in Sage (1987a).

At the Magpie Mine the siderite ore was cut out at the lower levels by a rock referred to as a mica dike (Collins and Quirke 1926). This mica dike intrusion increased in volume with depth and was a major factor in the demise of the mine. The rock piles at the mine site contain a large volume of this material and several specimens were examined in thin section.

The rock is grey green on weathered surface and some samples have a silvery lustre due to the mica grains.

In thin section, the rock is composed of chloritized biotite 25 to 75%, plagioclase 15 to 35%, and carbonate 15 to 35%. Minor quartz is also present.

The chloritized biotite defines a good schistosity and occurs in relatively large grains. In one specimen, the 001 cleavage was bent and deformed.

Plagioclase occurs in clusters of grains with a granoblastic texture. The plagioclase is saussuritized and contains inclusions of sericite, biotite, and carbonate.

The carbonate is dominantly anhedral, fine-grained and disseminated. In one specimen, the carbonate tended to be euhedral and porphyroblastic.

Large elliptical lense-like segregations of grey carbonate up to 0.3 m long are present within the Magpie Mine mica-rich intrusion. In thin section, these segregations consist of very fine-grained granoblastic quartz plus carbonate. Carbonate is estimated to form 85% of the segregations.

A rock consisting largely of chloritized biotite, carbonate and plagioclase defies clear classification. In general, it is best classified as a lamprophyre.

Collins and Quirke (1926) described the mica dikes as consisting of silvery talc and that it is highly magnesian but the presence of talc could not be confirmed. They observed the fine-grained carbonate segregations and concluded they were probably magnesite but this was not confirmed by the present study. Collins and Quirke (1926) correlated the mica dike at the Magpie Mine with mafic to ultramafic intrusions at Bauldry and Eleanor lakes. These units were subsequently described by the author (Sage 1987a). The author is reluctant to make such a long distance correlation particularly when the texture and mineralogy of the respective bodies are so different. The intrusion on Bauldry Lake looks slightly similar to the Magpie Mine mica dike in thin section but it does not appear to be similar to the mafic intrusions on Mildred and Eleanor lakes (Sage 1987a). A somewhat similar body of mafic rock with altered rounded xenolithic inclusions of actinolite occurs on the east side of Kapimchigama Lake in Leclaire Township near the west boundary of the map area.

South of the Magpie Mine, in Musquash Township and west of the Magpie River, several, small mafic intrusions that contain biotite and rounded mica-amphibole rich inclusions may be comagmatic with the mica dike and west of the Magpie Mine.

Along the southwest shore of Clearview Lake, a number of mafic inclusion-rich intrusive breccias were located. In general, their distribution is erratic and a discrete intrusions could not be clearly delineated at the scale of mapping.

The matrix to these breccias, is fine-grained consisting of chloritized biotite and carbonate. The xenoliths weather in relief above the black to dark green pitted matrix. The xenoliths are rounded to subangular up to 20 cm in diameter and a thin section of one xenolith indicated that it consisted of a mass of randomly oriented acicular amphibole. The matrix to the xenolith consists of clots of chlorite in a fine-grained amphibole-rich matrix. The opaques are fine-grained, disseminated and anhedral.

The xenoliths consist of mafic to felsic metavolcanic rocks. Bleached reaction rims up to 1 cm occur on the mafic clasts and a dark green to black ring up to 1 cm wide occurs in the matrix surrounding the xenolith. This dark ring, which visually appears to be chloritized biotite, may weather low with respect to clast and surrounding matrix. The rounded to subrounded fragments lack sorting and the breccia is matrix supported. Fragments may comprise up to 15 volume % of an intrusion. A possible granitic clast was noted in one small intrusion on Clearview Lake, Leclaire Township.

These xenolith-rich Lamprophyres are similar to ones exposed in road cuts along highway 17 west of the map area which have been classified as spessartite (gabbroic to dioritic) lamprophyre by Higgins (1986).

Intermediate to mafic intrusive rocks are common in Dunphy Township. They range from fine- to coarse-grained and weather black, dark green and green. On fresh surface, they are green to dark green in colour. The composition varies from quartz-diorite to gabbro with gabbro greatly dominating.

In most cases, the intermediate to mafic intrusive rocks appear conformable to the stratigraphy, but within the logged over area sharply crosscutting relations were established with the metasedimentary rocks. Even though sharp crosscutting relations existed between the metasedimentary rocks and intrusive rocks, the metasedimentary stratigraphy could be traced undisturbed across intervening areas of intrusive rocks. This observation suggests passive emplacement of the intermediate to mafic magmas.

A thin section prepared from a metagabbro sample indicated a fine- to medium-grained, inequigranular, massive, hypidiomorphic, granoblastic texture. The grain boundaries were curved to straight. The mode consists of an estimated 24% plagioclase and 75% actinolite with minor accessory magnetite.

The amphibole is fibrous or prismatic and pleochroic in brown and green. No relicts of the original mafic mineral from which the actinolite was derived were recognized.

The plagioclase is fine-grained, occurs in patches, and intimately mixed with the actinolite.

The magnetite occurs as aggregates of several grains randomly spread throughout the sample.

INTERMEDIATE TO FELSIC INTRUSIVE ROCKS (MAP UNIT 7)

Intermediate to felsic intrusive rocks within the map area can be subdivided into five major groups:

1) The trondhjemitic Gutcher Lake Stock and related phases

2) The fine-grained, commonly microporphyritic hypabyssal intrusions found at Big Lake, Perry Lake, Middleton Lake, and north of Middleton and East Middleton lakes and south of the Gutcher Lake Stock. These intrusions may be cogenetic with the Gutcher Lake Stock.

3) The Lund Lake Stock.

4) The Troupe Lake Stock.

5) The Hawk Lake Granitic Complex.

These various intermediate to felsic intrusions will be discussed individually. The internal granitic stocks represent two or more ages of emplacement as suggested by Bruce

(1940). The only stock dated by U-Pb isotopic techniques in the map area is the Gutcher Lake Stock dated at 2722±1 Ma (Turek et al. 1984).

HAWK LAKE GRANITIC COMPLEX

A small wedged-shaped block of granite in the southeastern corner of Corbiere Township is likely an eastern extension of the Hawk Lake Granite Complex exposed in Esquega Township (Sage 1987a). This wedge-shaped block of granitic rock is bounded on the west by the northwest striking Marsden Fault Zone and on the east by the McVeigh Creek Fault and is separated by faulting from the external granitic terrane. The projected southern extension of the Marsden Fault Zone joins with the McVeigh Creek Fault beneath the sand plain north of Hawk Junction. Extrapolating the supracrustal-granite contact to the Marsden Fault suggests a left-lateral offset of approximately 3.6 km. In Esquega Township, the Hawk Lake Granitic Complex varies in composition from trondhjemite to quartz monzonite. In Corbiere Township, the composition varies from trondhjemite to granodiorite. This difference in composition may reflect the fact that it was mainly the outer margins of the Hawk Lake Granitic Complex sampled in the map area and the margin is known to contain less potassium feldspar than the interior in Esquega Township (Sage 1987a).

The Hawk Lake Granitic Complex in Corbiere Township has a quartz-feldspar porphyritic border phase that is gradational from equigranular trondhjemite to granodiorite of the core similar to the rocks in Esquega Township (Sage 1987a). The quartz-feldspar porphyry is abundant on the shore of and south of Edwards Lake (local name). The size and quantity of quartz- feldspar intrusions decrease away from the Hawk Lake Granitic Complex. The quartz-feldspar porphyry intrusions that cut the bordering supracrustal rocks are apophyses of the Hawk Lake Granitic Complex. A similar relationship was noted in Esquega Township (Sage 1987a).

In Corbiere Township, the Hawk Lake Granitic Complex weathers white, grey or buff and on fresh surface is grey to buff colored. The granitic rocks in Corbiere Township are generally not as pink as the ones exposed in the core of the Hawk Lake Granitic Complex in Esquega Township. Turek et al. (1984) obtained a U-Pb age of 2888±2 Ma on the Hawk Lake Granitic Complex in Esquega Township west of the Marsden Fault Zone. This isotopic age combined with observed intrusive relations suggests that the supracrustal rocks flanking the Hawk Lake Granitic Complex in Corbiere Township may exceed 2888±2 Ma and are part of subcycle one (Sage 1987a).

In thin section, the rock is medium-grained, massive, equigranular, hypidiomorphic with straight to lobate grain boundaries. Microfracturing and crushing is common. The mode is estimated to be 30 to 35% quartz, 0 to 20% perthite, and 35 to 60% plagioclase (An 2 to 10).

The quartz is anhedral and displays wavy extinction. The plagioclase is turbid with the core of the grains being more altered than rims. The plagioclase is commonly anhedral. The plagioclase grains may be fractured and some grains display bent albite twin planes. The saussuritized turbid plagioclase grains contrast with the fresh perthite.

The perthite forms somewhat larger grains than the plagioclase and may enclose angular saussuritized plagioclase grains in random orientation. The perthite is sometimes an antiperthite and lacks the evidence for fracturing and stress that characterize the quartz and plagioclase. The potassium required to form the perthite has been remobilized during deformation or perhaps introduced later. Evidence for deformation and potassium remobilization or introduction observed in the Corbiere Township samples was not noted in the Hawk Lake Granitic Complex exposed in Esquega Township (Sage 1987a).

If the potassium feldspar observed in the Hawk Lake Granitic Complex samples in Corbiere Township have been metasomatically introduced, the rocks would originally have been almost exclusively trondhjemite. The samples of the Hawk Lake Granitic Complex examined from Esquega Township (Sage 1987a) are equigranular and collected from the centre of the complex while those in Corbiere Township are from the margin. This may account for the recognition of the possibility of greater deformation in the more peripheral Corbiere samples.

A limited number of samples were collected from the Hawk Lake Granitic Complex and analyzed for their major and trace elements. These data are presented on cation diagrams and AFM diagrams in Figure 2 and 3 and indicate the intrusive complex presently has a composition equivalent to rhyolite. Compared with the data from Esquega Township the rocks of the Hawk Lake Granitic Complex in Corbiere Township contain somewhat less potassium, reflecting a lower potassium feldspar content (Sage 1987a).

QUARTZ-FELDSPAR PORPHYRY OF THE HAWK LAKE GRANITE COMPLEX

Quartz-feldspar porphyries are abundant within the southeastern corner of Corbiere Township north of Hawk Junction. The porphyritic phases forming the border phases of the Hawk Lake Granite Complex are gradational into the plutonic equigranular phases of the Hawk Lake Granitic Complex. Quartz-feldspar porphyry also occurs as apophysis, isolated masses, and crudely curvilinear units that parallel the sharp outer contact of the Hawk Lake Granitic Complex with the supracrustal rocks. The quartz phenocrysts are up to 6 mm in diameter and occur in seriate distribution, may display a very faint opalescent blue tint, and may compose up to 20% of the rock. The quartz-feldspar porphyries described in adjoining Esquega Township are also part of the Hawk Lake Granitic Complex (Sage 1987a).

GUTCHER LAKE STOCK

The Gutcher Lake Stock has been studied in numerous brief reports since gold was discovered in 1921 at the Murphy Mine in the hornfelsed aureole and quartz-feldspar porphyry apophysis to the stock. The stock has been referred to as the Goudreau Stock (Emmons and Grout 1935).

The U-Pb age date of 2722±1 Ma on the Gutcher Lake Stock falls between the U-Pb age of 2749±2 Ma (Turek et al. 1982, 1984) obtained at the top of intermediate to felsic cycle one volcanism below the Michipicoten iron formation and the two U-Pb isotopic ages of 2696±2 Ma and 2698±11 Ma (Turek et al. 1982, 1984) obtained on intermediate to felsic metavolcanic rocks of the upper portion of cycle two. The Gutcher Lake Stock is therefore likely to be emplaced into intermediate to mafic metavolcanic rocks forming the lower portion of cycle two volcanism. The 20 million year age difference between the intermediate to felsic metavolcanic rocks of cycle two and the stock indicates that the stock is not likely a subvolcanic equivalent to the extrusive volcanic rocks of cycle two.

Collins and Quirke (1926) examined the stock just prior to the gold discovery at the Murphy Mine. They described the intrusion as having a serrated eastern margin lacking a metamorphic aureole, and lacking any evidence of assimilation of the enclosing wall rocks. They reported a chilled margin to the intrusion which along with the serrated eastern contact suggested to them forceful intrusion of the granitic magma. Mapping of the stock indicates an easily recognized metamorphic aureole is present. Evidence of assimilation such as schlieren and partially digested xenoliths is absent. Collins and Quirke (1926) also indicated a lack of evidence for assimilation by the intruding granitic magma.

Thomson (1926), Gledhill (1927), Moore (1931), Emmons and Grout (1935), and Bruce (1940) considered the quartz-feldspar porphyry intrusions that occur along the flanks of the stock and as isolated discrete bodies in the nearby metavolcanic rocks as cogenetic equivalents to the coarser grained equigranular interior of the stock. Quartz-feldspar porphyry has been reported to be gradational into granite porphyry, granite and alaskite at the Gutcher Lake Stock (Moore 1931). Granite porphyry and alaskite reported by Moore (1931) were not observed by the author.

Studemeister (1982) considers the quartz feldspar porphyry apophysis and nearby intrusions to be related to or to be cogenetic equivalents to the medium-grained equigranular core of the Gutcher Lake Stock. This observation is consistent with earlier observations by

Gledhill (1927), Moore (1931) and Emmons and Grout (1935) and the author agrees and has previously suggested an intimate relationship between equigranular granitic stocks and nearby quartz-feldspar porphyries in the Wawa area (Sage 1987a).

The quartz-feldspar porphyries occur north, east and south of the Gutcher Lake Stock and along its margin. The porphyries are more or less conformable to the enclosing metavolcanic rocks and are locally highly sheared. This relationship was also observed by Gledhill (1927) and Moore (1931). The marginal porphyritic phase is reported by Emmons and Grout (1935) to be approximately 20 feet wide but locally may be no more than 1 foot wide. The Gutcher Lake Stock was considered by Emmons and Grout (1935) to be more mafic on the north side and that the schistose zones are also wider in that area. An author noted an increase in color index within the granitic mass towards the northwest corner of the stock was noted confirming the observations of Emmons and Grout (1935). Some of the mafic minerals in this northwest area may be hornblende rather than biotite replaced by chlorite which is typical of the stock as a whole.

The long axis of tourmaline crystals in the border phase of the stock were observed by Emmons and Grout (1935) to plunge at a steep angle parallel to the long axis of hornblende crystals within the surrounding metavolcanic rocks. On the basis of this observation, they interpreted the stock to be a chimney-like mass with vertical walls extending to some unknown depth. Tourmaline crystals were not observed by during the present study in the border phases of the stock and no attempt to measure hornblende lineations in the hornfelsed aureole was made.

Studemeister and Colvine (1978), Studemeister et al. (1981), and Studemeister (1982, 1983, 1985a, 1985b, 1985c) have completed a detailed study on the Gutcher Lake Stock and surrounding stratigraphy. This study was directed towards understanding the mineral occurrences in the area and emphasizes the intrusive mechanism and metamorphic evolution of the stock and its enclosing supracrustal rocks. The voluminous data collected by Studemeister have been summarized by Studemeister (1982, 1983, 1985a, 1985b, 1985c).

Studemeister (1982, 1983, 1985a) described the Gutcher Lake Stock as having a surface area of 4 km^2 and a epidote hornfels aureole up to 1 km wide. Studemeister (1985b) referred to the stock as epizonal with a post emplacement regional foliation overprint. Studemeister (1982) stated that the stock can be subdivided into three zones from east to west. The eastern side of the complex displays a good schistosity while the west side is relatively massive. These zones from west to east are massive, gneissic, and schistose. The foliations are parallel to the regional foliations. The development of the foliation on the eastern side of the stock is thought by the author to result from post emplacement east to west shearing of the supracrustal rocks which would put the west side of the stock in a pressure shadow leaving it relatively unaffected. Studemeister (1982) described the texture of the relatively massive granitic rock as hypidiomorphic overprinted with a mild granoblastic recrystallized texture since the quartz is polygonalized but the feldspar is not. Studemeister (1982) classifies the granitic rock as trondhjemite and the author concurs with this nomenclature. Previous authors have referred to the stock as granodiorite (Gledhill 1927; Moore 1931; Emmons and Grout 1935). Bruce (1940) grouped the stock with feldspar porphyry and quartz porphyry dikes.

Fractures filled with quartz, white mica, calcite, ankerite, chlorite and pyrite cut the stock and its hornfelsed aureole (Studemeister 1983, 1985b, 1985c). The regional foliation crosses both the stock and its aureole as observed by the author and Studemeister (1983, 1985b, 1985c). The massive trondhjemite grades into schistose trondhjemite at dike and stock margins presumably due to regional shearing (Studemeister 1983, 1985a). These schistose marginal phases are described by Studemeister (1983, 1985a) as consisting of a fine-grained leucocratic matrix of quartz, nearly pure albite, white mica, calcite, and chlorite that wraps around larger porphyroclasts of anhedral quartz and albite. The schistose phase contains more white mica and carbonate and less feldspar than the massive phase. The white mica is described as phengitic muscovite and paragonite, and the carbonate as calcite plus ankerite by Studemeister (1985a).

The massive trondhjemite has a mildly granoblastic recrystallized texture with a mode estimated by Studemeister (1982, p.102) at 50 to 60% plagioclase, 20 to 30% quartz, 10% chlorite, with minor to accessory white mica, calcite, alkali feldspar, epidote, sphene, biotite, and apatite. However, Studemeister (1982, p.95-96) gives a different mode that indicates a greater spread in the in modal percentages. The mineralogy is the same in all phases with the schistosity in the schistose phases being defined by the mica and to a lesser extent by chlorite, calcite, quartz and feldspar (Studemeister 1982).

The plagioclase to potassium feldspar ratio is less than 1:8 and potassium feldspar forms less than 5 modal % (Studemeister 1983, 1982). The low potassium feldspar content and low colour index indicates a trondhjemite rather than granodiorite as reported by Moore (1931). Moore (1931) reported the presence of orthoclase which was not confirmed by the author or by Studemeister (1982).

The quartz is described by Studemeister (1982, 1983) as medium- to fine-grained recrystallized colourless to faintly blue grains. Fine-grained quartz occurs with white mica, calcite, chlorite and epidote as amoeboid inclusions and as part of an interstitial matrix to the feldspar and quartz (Studemeister 1982).

The plagioclase is recrystallized and consists of a central zone mottled by white mica, quartz, epidote, and calcite (Studemeister 1982, 1983). The anorthite content of the core of the plagioclase grain was estimated at approximately 15% by Studemeister (1982, 1983, 1985a, 1985b, 1986b) and this altered core is enveloped in a rim of clear albite.

The most abundant mafic mineral is chlorite which pseudomorphs biotite, hornblende, epidote, in association with sphene, calcite, and quartz (Studemeister 1983, 1985b, 1985c). Studemeister (1983) indicated that tremolite-actinolite is also present in minor amounts. Chlorite is also present interstitial to the plagioclase and occurs in clasts associated with sphene where replacing biotite (Studemeister 1985a). The chlorite is referred to as prochlorite by Studemeister (1982).

The white mica is a phengitic muscovite or paragonite and the epidote is an aluminum-rich pistacite with 10 to 15% Fe_2O_3 (Studemeister 1982, 1985a, 1985c).

The very minor amount of potassium feldspar contains blebs of albite, is mottled with white mica and quartz, and has a rim of clear albite (Studemeister 1982).

The author did not examine as large a sample suite as Studemeister (1982). On the basis of a limited sample population, the author would describe the massive trondhjemite as having a medium-grained equigranular massive, hypidiomorphic texture with curved to straight grain boundaries.

The mode was estimated as 30 to 35% quartz, 60 to 70% plagioclase (An 30 to 35) with subordinate amphibole, epidote, carbonate, chlorite, opaques, and sericite present in amounts varying from trace to 5%.

The quartz is polycrystalline and interstitial to the plagioclase. The quartz may partially enclose plagioclase.

The anhedral to euhedral plagioclase is extensively saussuritized. The cores are turbid from the inclusions resulting from saussuritization. The cores are rimmed by moderately fresh to fresh clear sodic plagioclase. The cores of several crystals display an apparent concentric pattern which may infer that the crystals were originally compositionally zoned. On the basis of optical data, the plagioclase appears to have a higher anorthite content than that reported by Studemeister (1982).

Carbonate is interstitial, anhedral and scattered throughout the rock as tiny grains.

The chlorite occurs as isolated clusters of micaceous flakes, fracture fillings and spotty replacement of plagioclase feldspar. In most specimens, the chlorite likely replaces biotite however in the more mafic northwest corner of the stock the chlorite appears to be replacing amphibole.

The author has observed rare fine-grained aplite, feldspar porphyry and quartz feldspar porphyry dikes cutting massive trondhjemite southwest of Gutcher Lake. The dikes appeared to have variable strike. The dikes are few in number and were not encountered in most traverses of the stock.

The dikes were not examined in thin section.

A relatively large group of samples were collected from the Gutcher Lake Stock and analyzed for major and minor elements. These data are present on AFM plots and cation diagrams (Figures 12 and 13). The data are tightly clustered. The data are generally compatible with the concept that compositionally, the Gutcher Lake Stock could be the source of cycle two intermediate to felsic metavolcanic rocks however existing U-Pb isotopic ages do not support such a relationship. Some caution should be exercised when comparing the present granitic rock composition with metavolcanic rock compositions since it can not be established that the present granitic rock compositions are magma equivalent.

QUARTZ, FELDSPAR AND FELDSPAR PORPHYRY

Moore (1931) reported that the phenocrysts in the quartz-feldspar porphyries are in a matrix of biotite, hornblende, chlorite and rutile. He reported the feldspars to be orthoclase and albite. Orthoclase phenocrysts were not observed by the author nor were they reported by Studemeister (1982) in his detailed study of the stock. The rutile reported by Moore (1931) marginal to veins is likely tourmaline which was described by Studemeister (1982). Moore (1931) reported that some of the phenocrysts display replacement by carbonate and minor carbonate replacement does occur as a part of the saussuritization process.

Studemeister (1982) completed the most detailed study of the quartz feldspar porphyry intrusions enclosing the Gutcher Lake Stock. Studemeister (1982) found dikes of quartz-feldspar porphyry 0.5 to 1 m wide up to 3 km from the stock. The Murphy Mine lies near the south contact of a long apophysis of quartz-feldspar porphyry that extends from the east contact of the stock to just west of Rowan Lake. This apophysis approaches widths of several hundred metres. Most quartz-feldspar porphyry dikes studied by Studemeister (1982) strike east-northeast to east-southeast and contain up to 40% combined quartz plus plagioclase phenocrysts.

The feldspar phenocrysts are saussuritized and consist of a mixture of albite, white mica, quartz, and calcite (Studemeister 1982). Accessory epidote, sphene, pyrite, apatite, magnetite and tourmaline were reported by Studemeister (1982).

Only one quartz-feldspar porphyry sample from the southeast corner of the Gutcher Lake Stock was examined by the author. The quartz-feldspar porphyry weathers white, buff, or grey and has a grey to grey pink color on fresh surface. Phenocrysts of quartz and feldspar up to 7 to 8 mm in diameter may be present which together may occur in quantities exceeding 40%. The texture in thin section is fine- to medium-grained, porphyritic, seriate and hypidiomorphic with straight to curved grain boundaries. The quartz is euhedral to subhedral and unstressed. One quartz crystal contained a euhedral inclusion of possible amphibole now replaced by chlorite. Trace to 1% clinopyroxene with ragged chlorite replaced ends was enclosed in one feldspar crystal. Minor epidote was present.

The plagioclase (An_{32}) feldspar is euhedral to anhedral in outline and extensively altered to saussurite. A concentric alteration pattern on several feldspar crystals suggests some feldspars were originally compositionally zoned. The phenocrysts were essentially totally altered and lack the clear albite rim that characterizes the medium-grained equigranular core of the stock.

The matrix to the phenocrysts consists of a fine-grained mosaic of granoblastic quartz and untwinned plagioclase.

Minor quartz-feldspar porphyry units were noted on the south and north shores of Mall Lake. The larger unit north of Mall Lake interdigitates with sheared, amygdaloidal, pillowed intermediate to mafic metavolcanic rocks. The contacts, while sheared, are interpreted by the author as intrusive. Studemeister (1982) interpreted these units as crystal tuffs. The author considers them to be minor intrusions similar to the porphyritic border phase of the Gutcher Lake Stock and directly related to stock emplacement.

HYPABYSSAL INTRUSIONS

Hypabyssal intrusions are common in Corbiere and Abotossaway townships. They may exist in Leclaire Township and are present in Jacobson Township near Lochalsh in the adjoining map area (Sage 1987c). These intrusions are interpreted by the author to possibly be consanguineous with the emplacement of the Gutcher Lake Stock a relationship suggested by Bruce (1940). Bruce (1940) suggested that these hypabyssal intrusions may be the upper part of stocks similar to the Gutcher Lake Stock. The author considers the fine-grained nature likely to extend to considerable depth and a coarser plutonic phase may not be present.

These hypabyssal intrusions are very fine-grained, aphanitic and occasionally have a phenocryst of quartz or feldspar that does not exceed 1 mm in diameter. The phenocryst content rarely exceeds an estimated 1% of the rock. Bruce (1940), found it difficult if not impossible to establish clear cut intrusive relations where these fine-grained rocks strike parallel to the enclosing metavolcanic rocks. The author concurs with this observation.

These intrusions weather buff, grey, or white and contrast sharply with the dark green color of the enclosing intermediate to mafic metavolcanic rocks. The intrusions are easily confused with massive intermediate to felsic flows. This makes it difficult to outline the western limits of the hypabyssal intrusion at Big Lake, Corbiere Township. Some of outcrops west of Big Lake mapped by the field party as intermediate to felsic metavolcanic rocks are likely part of or apophysis of the Big Lake hypabyssal intrusion. The Big Lake intrusion could be the subsurface cogenetic equivalent of the intermediate to felsic metavolcanic rocks that occur to the west and northwest, but U-Pb isotopic ages will be required to establish the relationship. Such a relationship would negate any correlation with the Gutcher Lake Stock.

The Big Lake hypabyssal intrusion has a maximum width of 0.8 km at Big Lake and may have a strike length of approximately 2.4 km. The intrusion is texturally and compositionally homogeneous and has undergone pervasive saussuritization. On the north side of Big Lake, crosscutting intrusive contacts were observed between the intermediate to mafic metavolcanic rocks and the hypabyssal intrusion.

On the south side of Perry Lake, in Abotossaway Township, another hypabyssal intrusion is present. The contacts between the host intermediate to mafic metavolcanic wall rocks and the intrusion are sharp, sheared, and conformable. At the west end of the intrusion, sill-like apophysis are present in the intermediate to mafic metavolcanic rocks. Dike and sill-like apophysis from the main mass support an intrusive origin for this body. The Perry Lake intrusion is approximately 1.4 km long and has a width that locally exceeds 0.4 km.

Studemeister (1982) classified the Perry Lake intrusion as quartz albite felsic metavolcanic rocks consisting of fine-grained flows and tuffs. Studemeister (1982) did not report layering or fragmental textures in the Perry Lake intrusion. He observed crosscutting dikes related to the Perry Lake mass, but mapped the crosscutting units as metavolcanic rocks.

Studemeister (1982) described the Perry Lake intrusion as blastoporphyritic with 1 to 5 mm quartz and albite phenocrysts. The mode was given as 45 to 50% albite, 35 to 40% quartz, 10 to 15% sericite and less than 5% calcite, chlorite, epidote, and pyrite (Studemeister 1982).

A similar mass of intrusive rock occurs at the southwestern corner of the Gutcher Lake Stock northwest of Perry Lake. This intrusion is highly fractured or jointed which may in part be due to the Marsden Fault which passes through this small mass and along the west side of the Gutcher Lake Stock.

The contacts of this intrusion are sharp with the enclosing intermediate to mafic metavolcanic wall rocks, and the intrusion appears to crosscut the enclosing rocks at a shallow angle. This mass is approximately 0.8 km long and has a maximum width of approximately 0.4 km. The long axis of this mass strikes northwest contrasting with the northeast to east striking long axis of the other hypabyssal intrusions.

Two more hypabyssal intrusions are present north of Middleton Lake. The southern intrusion has a maximum width of approximately 0.4 km and a strike length of approximately 1.6 km. This unit is centered on the north side of East Middleton Lake.

This unit is described by Studemeister (1982) as a white mica, quartz, albite rock of felsic volcanic origin. Studemeister (1982) described the rocks as crudely laminated with scattered subrounded felsite clasts supported by a fine-grained matrix. The rock is gradational into a mesocratic layered schist with quartz, chlorite, calcite, and white mica (Studemeister 1982). Studemeister (1982) reported rare subrounded quartz and felsite clasts and classified the rock as massive reworked tuffs, lapilli tuff, crystal lapilli tuff, and tuff breccia. He reported up to 10 to 15% subangular to subrounded felsite clasts being present. The author did not observe volcaniclastic textures in this unit. Studemeister (1982) reported dikelets of similar rock associated with the quartz albite rocks of the Middleton Lake area and Bruce (1940) reported the north contact of this mass was intrusive in the area of Rowan Lake. The dikes and the contact relations indicate an intrusive origin and the author concurs with the earlier interpretation of Bruce (1940) that this felsic body intrudes the intermediate to mafic metavolcanic rocks.

Separated from the above intrusion by a narrow band of massive mafic metavolcanic rocks with a minimum width of approximately 30 m is the northern hypabyssal intrusion. This northern hypabyssal unit has a maximum width of approximately 0.4 km and a strike length estimated at 3.2 km. This unit is the longest hypabyssal intrusion recognized in the map area. Clear crosscutting relations were at no place clearly established for this unit. The southern part of this intrusion is similar, if not identical, to the southern intrusion on Rowan Lake that displays clear crosscutting relations with the intermediate to mafic metavolcanic rocks. The upper part of this body is, however, clearly volcaniclastic. The north side of this body locally is thin bedded and displays good north-facing graded bedding. Lapilli tuff, and tuff breccia are also common particularly along the east end of the unit. The volcaniclastic rock contains abundant chlorite and within the tuff breccia at the east end of the unit fine-grained mafic fragments consisting of chlorite are abundant. The mafic clasts have irregular shapes and diffuse contacts. The volcaniclastic rocks appear locally to grade into the lower massive homogeneous intrusive phase, however, in other areas closely spaced outcrops of volcaniclastic rock and intrusive rock imply the existence of a sharp contact. The presence of chlorite and chlorite-replaced mafic fragments thought to have originally been fine-grained mafic tuff contrasts with the leucocratic chlorite free lower part of the unit. Bruce (1940) interpreted this mass to be intrusion on the basis of its homogeneity and its similarity to the southern body which has clear cut intrusive relations. The author agrees with this interpretation. These bodies were emplaced at a very high level and could have clearly had an extrusive component. The author interprets the volcaniclastic material on the north side of this more northern body as the result of erosion, reworking and removal of a thin covering of tufaceous intermediate to mafic metavolcanic rocks. The intermediate to felsic metavolcanic component represents reworked material possibly a regolith from the underlying hypabyssal intrusion and the mafic debris is allochthonous. The mafic component represents the mixing of intermediate to mafic tuff derived from the nearby intermediate to mafic metavolcanic rocks with felsic volcaniclastic material during erosion at the surface. The introduction of some intermediate to felsic volcanic clasts from an outside source is suggested by the porphyritic textures and color of weathering displayed by some small lapilli size fragments in the bedded tuffs. This model suggests that the north side of this hypabyssal intrusion may represent the site of a minor paraconformity within the stratigraphy.

Studemeister (1982) classified this northern hypabyssal intrusion as a quartz albite rock which grades laterally into a heterogeneous assemblage of felsic tuffs intercalated with mudstone and minor cherty iron formation. Mapping by the field party failed to establish such a lateral gradation or the nearby presence of some of the rock types reported by Studemeister (1982). The lithologic gradation is vertical and not lateral and this is likely due to erosion and reworking of the surface of a sill-like hypabyssal intrusion. Studemeister (1982) reported less than 10% quartz and albite phenocrysts in this rock. Mapping by the author suggests such phenocrysts rarely exceed 1 mm and rarely exceed 1 or 2% of the rock. Studemeister (1982) classified these rocks as lapilli tuff, crystal lapilli tuff, and tuff breccia.

A small body of intermediate to felsic intrusive rock extends from the southwestern to the south central section of Middleton Lake. This body is identical to the other hypabyssal intrusions in the area. Studemeister (1982) classified this intrusion as white mica, quartz, albite rock and included it with his lapilli tuff, crystal lapilli tuff, and tuff breccia. Studemeister (1982) described the unit as homogeneous and possibly a viscous siliceous flow. Studemeister (1982) reported dikelets of similar rock to be associated with the Middleton Lake quartz albite rock. This supports an intrusive rather than extrusive origin.

Bruce (1940) interpreted this fine-grained felsic rock at the southwestern corner of Middleton Lake as intrusive. Mapping by Bruce (1940) and the author suggests that this intrusion may not be one continuous unit lying south of Middleton Lake but actually is several disconnected aligned intrusive masses.

A small hypabyssal intrusion is also present on the north side of an unnamed lake in the northeastern corner of Abotossaway Township. This body appears to cut an intermediate to mafic intrusion and is identical in appearance to the other fine-grained hypabyssal intrusions within the map area.

A suite of samples from the hypabyssal intrusions were examined and they all are of similar appearance. In thin section, the rocks are fine-grained microporphyritic to seriate, hypidiomorphic to allotriomorphic. Grain boundaries are curved to straight. Most samples lack phenocrysts. Plagioclase phenocrysts (An_2 to An_{10}) and quartz phenocrysts form less than 1% of the porphyritic rocks. The mode is estimated as 20 to 30% quartz, 50 to 60% untwinned plagioclase, 5 to 25% sericite, 0 to 15% chlorite, 0 to 10% chlorite, and minor epidote. The quartz and plagioclase form a fine-grained, equigranular, granoblastic matrix and the micaceous minerals impart a schistosity to the rock. One plagioclase phenocryst was optically identified as having a calcic oligoclase - sodic andesine composition. This is much more calcic in composition than most phenocrysts. It is uncertain whether this is a primary composition or the result of some unknown metamorphic event.

Bruce (1940) reported that these fine-grained intrusions contain orthoclase, sodium oligoclase, muscovite, and hornblende. He described the rock as quartz-rich. The author did not identify orthoclase or hornblende and the rocks are not unusually rich in quartz for an igneous rock.

A suite of samples were taken from the hypabyssal intrusions in the Middleton Lake and Perry Lake areas and their major and minor elements determined. The data were plotted on AFM diagrams and cation plots. The data indicate a scattering in alkali element content on a AFM diagram and relatively tight clustering of data on a Cation plot (Figures 14 and 15). The chemical data is compatible with the intermediate to felsic metavolcanic rock chemical data for second cycle volcanism obtained by Sage (1987a), however, the existing U-Pb isotopic ages would not support such a correlation if the assumption is made that the hypabyssal intrusions and Gutcher Lake Stock are coeval. The author considers these hypabyssal intrusions to be coeval with the Gutcher Lake Stock a concept previously proposed by Bruce (1940). The major element chemical data, however, indicates major differences in the content of mobile alkali elements and iron when a comparison is made between the Gutcher Lake Stock and hypabyssal intrusions. These hypabyssal intrusions display a pattern of spatial association with the Gutcher Lake Stock by crudely encircling the stock, but rock chemistry indicates that any proposed relationship may not be simple or that one or both intrusive types have been metasomatically altered to differing degrees. One can speculate that the crude distribution of hypabyssal intrusive rocks around the Gutcher Lake Stock represents former ring fracturing caldera subsidence and intrusion. This Archean caldera was then deformed during regional deformation destroying the typical annular pattern of ring fracturing and intrusion.

LUND LAKE STOCK

A small granodiorite stock is present on the north shore of Lund Lake in Leclaire Township. This stock is approximately 0.8 km in diameter and is crosscut by numerous northeast and northwest striking diabase dikes. The stock is medium- to coarse-grained and appears to have been emplaced in the faulted axial plane of the Centre Anticline. The rock weathers buff, pink, and red and on fresh surface is pinkish red. The feldspars are clouded suggesting mild alteration of the stock.

Samples suitable for analysis and study were difficult to obtain. A large sample taken for the purpose of obtaining zircons for a U-Pb age date displayed a rare grain of molybdenite of less than 0.5 mm in diameter. This sample was collected at the southeastern corner of the stock on Pashoskoota Lake.

In thin section, the rock is medium- to coarse-grained seriate and hypidiomorphic with straight to curve grain boundaries. The plagioclase is fractured and bent albite twin planes indicate a protoclastic texture. The mode is estimated to be 30-35% quartz, 30 to 35% plagioclase (An_5 to An_{10}) and 30 to 35% perthite. Traces of chlorite possibly after biotite were present as well as minor sericite.

The quartz is anhedral interstitial, and may enclose angular plagioclase grains.

The plagioclase is anhedral with bent albite twin planes. The plagioclase is dusted with saussurite and much fresher in appearance than the plagioclase found in the Gutcher Lake Stock.

The perthite is a good string perthite with rare Carlsbad twinning. The perthite is fresh, anhedral and encloses fragments or crystals of plagioclase. One crystal of perthite enclosed a small grain of chlorite which possibly replaced biotite.

Several large grains of sericite were noted between the feldspar grains. Several grains of biotite replaced by chlorite occur between grains. On the basis of potassium feldspar to plagioclase ratios, the rock varies between granodiorite and quartz monzonite in composition.

Small isolated outcrops of similar granitoid rock occur west of Evans Creek and east of Alice Lake in Central and southeastern Leclaire Township respectively. The presence of these small isolated granitic masses suggests they are the surface expression of a larger mass at depth. The supracrustal rocks of Leclaire Township are generally not as pervasively impregnated with carbonate as rocks in Corbiere and Abotossaway townships. One possible explanation is that a granitic intrusion at depth has supplied sufficient heat to partly devolatilize the metavolcanic rocks in parts of Leclaire Township.

The Lund Lake Stock weathers deeper than most granitic intrusions in the area and samples were often stained with iron along fractures. Samples of fresh rock were difficult to obtain. Three samples of the freshest rock obtainable were taken for complete rock analysis and these chemical data are illustrated on an AFM diagram and a cation diagram (Figure 16 and 17). The data indicate the Lund Lake Stock has a composition equivalent to rhyolite. The number of samples analyzed are too few to precisely define the chemistry of the stock but it did appear relatively homogeneous in composition.

TROUPE LAKE STOCK

Intermediate to felsic intrusive rocks within Dunphy Township are exclusive of and related to the Troupe Lake Stock (Emmons and Grout 1935) . Two dikes of Troupe Lake Stock were encountered in railroad cuts of the Algoma Central Railroad, however, dikes related to the Troupe Lake Stock were not encountered in other areas.

The geology of Dunphy Township to some extent is dominated by the Troupe Lake Stock.

The Troupe Lake Stock is characterized by large phenocrysts of microcline feldspar (Plate 8). In the field, the stock forms large outcrops with widely spaced jointing. The weathered surface is pink, pale pink to buff and the phenocrysts weather in subtle relief. Exposed contacts of the stock with its external supracrustal rocks are rare but a good exposure of a contact can be examined on the high ridge approximately 0.4 km west of the Algoma Central Railway in the northern part of the mapped area.

The distinctive microcline phenocrysts are up to 3 cm in maximum length, randomly oriented and seriate in distribution. In outcrop, the phenocrysts appear euhedral and it is not apparent that they contain abundant inclusion.

Thin sections of the rock indicate a fine- to coarse-grained porphyritic seriate texture with curved to straight grain boundaries. An estimated mode of 25 to 30% quartz, 25 to 30% microcline, 30 to 35% plagioclase, and 5 to 10% biotite was obtained. Accessory epidote, sphene, sericite, and zircon were noted. Sphene, as euhedral wedge-shaped crystals, was particularly abundant and the stock appears to be enriched in sphene. Epidote as tiny anhedral grains is a ubiquitous product of alteration of feldspar and mafic minerals.

The quartz occurs as an interlocking mosaic of grains interstitial to the feldspar in the matrix. A weak wavy extinction may be present.

The biotite is anhedral commonly associated with epidote, both of which are interstitial to the plagioclase feldspar that makes up the groundmass to the microcline phenocrysts.

Plagioclase is anhedral to subhedral in outline, tabular, and displays alteration to sericite and epidote. Several of the larger grains display bent twin lamellae and weak fracturing suggestive of a protoclastic texture in the matrix to the microcline phenocrysts.

These unusual microcline phenocrysts display a typical string perthite texture and often display Carlsbad twinning. The edges of the phenocrysts are ragged. Abundant inclusions of subhedral plagioclase and uncommon inclusions of sphene, biotite and quartz are found in the phenocrysts. The plagioclase inclusions display the sericite and epidote alteration that characterized the plagioclase outside the phenocryst. Due to the plagioclase inclusions, the microcline phenocrysts have the appearance of being porphyroblasts rather than phenocrysts. The quantity of groundmass microcline is greatly subordinate to the phenocrysts. The microcline is always fresh, while the plagioclase always displays sericite and epidote alteration. The microcline phenocrysts have the appearance of being late in petrogenesis and on the basis of freshness and textural relationships grew in a largely stagnant and partly crystallized magma.

The Troupe Lake Stock sharply cuts the supracrustal rocks and observed contacts are knife-edged. Phenocrysts occur at the contact even though slightly smaller in size. There is an absence of significant chilling of the granitic magma in proximity to the contact. An aureole of contact metamorphism surrounds the stock that may reach a maximum width of 300 m. The contact aureole is of amphibolite grade next to the granite and rapidly diminishes to the lower grades of regional metamorphism away from the stock. The higher grade rock generally does not exceed a width of 100 m.

The contact hornfels is commonly iron stained and contains both disseminated pyrite and pyrite along fractures.

The bulk composition of the Troupe Lake Stock is granodiorite to quartz monzonite. Bruce (1940) has a good photograph of the porphyritic texture found in the Troupe Lake Stock.

Emmons and Grout (1935) noted the random orientation of the feldspar phenocrysts and reported the presence pegmatite and aplite at the north end of the stock. This aplite and pegmatite was not found by the field party.

MINOR INTERMEDIATE TO FELSIC INTRUSIONS

Minor intrusions such as feldspar porphyry and quartz-feldspar porphyry dikes and sills are abundant within the map area. These dikes are particularly common in the Reau-Mary lakes area extending north and northwest to the area south, east and north of the Gutcher Lake Stock. It is uncertain whether these dikes are related to the Gutcher Lake Stock or represent independent intrusive events. Some of these dikes weather with the phenocrysts in relief and have the appearance of a typical crystal tuff. In some instances, it is difficult, if not impossible to determine, whether individual outcrops represent porphyritic dikes or tuff units.

Individual porphyritic dikes commonly do not exceed 3 m in width. The weathered surfaces vary from buff, grey, to grey buff. On fresh surface, the dikes are greenish pink, pinkish green, and green.

In thin section, the porphyritic dikes are fine- to medium-grained, porphyritic, seriate and hypidiomorphic with straight to curved grain boundaries. The mode is highly variable and estimated as 10 to 30% plagioclase phenocrysts, 0 to 10% quartz phenocrysts, and 70 to 90% fine-grained matrix. Carbonate, chlorite, and trace amounts of opaques are minor accessories.

The plagioclase (An_5 to An_8) varies from rounded to euhedral crystals. Some crystals are fractured and the crystals are saussuritized.

Quartz phenocrysts are rounded to subrounded and locally may displayed embayed margins.

The matrix is an equigranular, granoblastic mosaic of quartz and untwinned plagioclase. The matrix may contain abundant fine-grained sericite, carbonate, and chlorite.

The author did not observe crosscutting relations between the feldspar porphyry dikes and quartz feldspar porphyry dikes. Bruce (1940) reported that fine-grained felsite dikes were cut by quartz-feldspar porphyry dikes. The felsite dikes described by Bruce (1940) may be feldspar porphyry dikes.

PROTEROZOIC

DIABASE AND MISCELLANEOUS DIKES (MAP UNIT 12)

DIABASE DIKES

Diabase dikes are abundant within the map area. The trend is dominantly northwest in Abotossaway, Corbiere, Dunphy and Musquash townships. They are not uncommonly 15 m or more in width. In Leclaire Township, dikes trend both northwest and northeast. In the northwestern corner of Leclaire Township, dikes are up to 66 m wide. The dikes commonly display good chilled margins of variable width. The dike centres are commonly medium- to coarse-grained.

The diabase weathers black, greenish black, and greenish and has similar tints on fresh surface. The dikes are fine- to medium-grained with the coarser grain size being located along the centre of the dike.

Some dikes contain phenocrysts of green subhedral to euhedral saussuritized plagioclase that occur as single crystals or as glomeroporphyritic aggregates. The larger phenocrysts are concentrated towards the center of the dikes and the chilled margins are phenocryst free. Phenocryst-rich diabase may grade along strike into phenocryst free diabase. The contact hornfels bordering the larger dikes (up to 66 m) in the northwestern corner of Leclaire Township is 30 or more metres in width. It would appear that the width of hornfels developed would require much more heat than would be available in a static magma represented by the 66 m wide dike. The contact hornfels is equivalent to amphibolite facies conditions which Winkler (1967) indicated requires a temperature of at least 500°C. On the basis of theoretical modeling, Jaeger (1967) has indicated that a static magma at a temperature equivalent to a diabase magma would have a temperature profile where temperatures in the wall rock would equal or exceed 500°C at a distance into the dike walls of much less than half the dike width. It is therefore likely, that the larger dikes represent conduits for through flowing mafic magma to account for such a wide aureole of contact metamorphism. If these dikes had an effusive product it no longer appears to be present in the area.

The northwest trending dike or dikes on the west side of Punk and Reynolds lakes, in Leclaire, Musquash and Corbiere townships, have a strong linear aeromagnetic anomaly, however, most dikes have little if any aeromagnetic expression (AFRO).

Crosscutting relations between northwest- and northeast- trending dikes were not observed. This may be due to a lack of locating a definitive outcrop. The author tentatively considers the dikes of both trends to be cogenetic, emplaced into a conjugate shear or fault system.

The major mapping effort was to establish dike trends and position. The importance of the dikes is in understanding the structural geology of the area since the dikes usually occupy shear and fault zones.

Many details of the diabase dikes of the Wawa area were given in Sage (1987a).

A limited suite of diabase dikes were thin sectioned. This sample suite is located principally in Leclaire Township.

In thin section, the dikes were fine- to medium-grained, massive, equigranular and hypidiomorphic with straight to curved grain boundaries. The samples examined were fresh. The mode is 50 to 60% plagioclase (An49 to An54), clinopyroxene 40 to 50% and 1 to 5% opaques. Traces of biotite and 0 to 5% quartz may be present.

The plagioclase is fresh, anhedral to euhedral and may be fractured and display bent albite twin planes. Some crystals display traces of saussuritization.

The clinopyroxene is an anhedral augite which is interstitial to the plagioclase. The pyroxene is sometimes twinned and fresh in appearance. Traces of biotite in association with magnetite may locally replace clinopyroxene along the edges of some crystals.

The opaque is magnetite and commonly skeletal. It is generally disseminated and anhedral in outline.

Quartz, where present, is anhedral, interstitial and clearly late in the crystallization sequence. The freshness of the samples suggests that the quartz is primary.

Olivine, or its alteration products, was not recognized in any sample. The dikes are quartz diabase representing a silica saturated to slightly silica oversaturated mafic magma.

One specimen with green plagioclase phenocrysts was thin sectioned. Optically, the plagioclase phenocryst and matrix plagioclase were the same composition.

SYENITE DIKE

On the southwestern corner of Ireland Lake, Leclaire Township, an irregular dike of feldspar porphyry is present. This dike is fresh in appearance and not like the typical Archean feldspar porphyry dikes. The dike contacts are unsheared. This dike was arbitrarily mapped as a Proterozoic syenite dike but is unlike previously mapped Proterozoic syenite dikes of the region, which are brick red in color and microporphyritic (Sage 1987a).

In outcrop, the dike is grey and on fresh surface the dike is pinkish grey. The dike is composed of 50 to 70% grey feldspar. The feldspar crystals are euhedral, display a pronounced concentric zoning, and reach a length of approximately 1 cm. The dike was irregular in trend and width but did reach a width of approximately 5 m. Angular metasedimentary rocks xenoliths were present in the dike and the aligned feldspars display a trachytoidal texture.

In thin section, the rock is fine- to medium-grained, porphyritic, seriate and hypidiomorphic with straight to lobate grain boundaries. The plagioclase (An8) occurs as euhedral crystals which display bent albite twin planes, are fractured and are relatively fresh. The feldspars display a protoclastic texture. The mode of one specimen was 50% plagioclase feldspar, 25% plagioclase matrix and 25% amphibole. Traces of magnetite were noted.

The amphibole was pleochroic in pale green, prismatic and displayed rare twinning. The matrix consists of twinned and untwinned plagioclase with interlocking lobate grain boundaries.

PHANEROZOIC
CENOZOIC
PLEISTOCENE AND RECENT

Within the map area, Pleistocene and Recent deposits consist of sand, gravel silt and organic matter. Along the north side of Leclaire and Abotossaway townships outcrop becomes scarce and an extensive area of sand and gravel are present. Isolated boulders consisting of various granitic rocks derived from the granitic terrane north of the Wawa supracrustal belt.

Along McVeigh Creek, on the east side of Abotossaway and Corbiere townships, local sand, gravel and silt deposits occur within the fault valley but the deposits are generally not extensive.

The most spectacular area of Pleistocene and Recent deposits occurs as river terraces along the Magpie River. Within Leclaire and Musquash townships, the sand, gravel and silt deposits are extensive but the terraces are not as well preserved as in the adjoining area to the south (Frey 1986; Sage 1987a). Along the Magpie River the terraces are the result of incision by the Magpie River into extensive glaciofluvial or glaciolacustrine valley train deposits (Frey 1985, 1986). Frey (1985, 1986) reported the presence of 6 paired terraces with a topographic relief of approximately 60 m. The terraces continue horizontally for several kilometres and terminate abruptly in some cases with downstream escarpments (Frey 1985, 1986). Frey (1985, 1986) correlated the highest terrace with the Minong shoreline. Each terrace surface is characterized by a lag concentrate of rounded cobbles and boulders from 0.5 to 3 m thick (Frey 1985).

Away from the Magpie River, curvilinear moraines and large isolated erratic overlie glacially moulded bedrock (Frey 1985, 1986). The moraines are small and dispersed, seldom exceeding 500 m in length or 20 m in relief (Frey 1985, 1986). Frey (1985, 1986) interpreted both the morainic deposits and the accompanying small areas of kame and kettle topography to indicate a rapid glacial recession.

The authors encountered numerous instances where the valley floors between large hills were paved with large boulders. These boulder trains lack fine interclast sand, silt and gravel suggesting that they mark melt water discharge channels which removed the finer material leaving the boulders. While these deposits are minor they are sufficiently widespread as to be a common feature of the area.

Large boulders of nepheline and cancrinite syenite derived from the Herman Lake nepheline syenite complex were encountered in Corbiere Township.

METAMORPHISM AND ALTERATION

SUPRACRUSTAL-EXTERNAL GRANITIC CONTACT

In the map area, the external granitic terrain is exposed only in the northern limits of Leclaire, Abotossaway townships and southeastern Dunphy Township and in the extreme southeast corner of Corbiere Township. The metamorphic assemblage is telescoped, with typical greenschist facies rank rocks of the belt core surrounded by a relatively narrow zone of amphibolite facies rank rocks as the external granites are approached (Ayres 1978). Ayres (1978) attributed the higher metamorphic grades adjacent to the external granitic rocks as a product of contact metamorphism with the intruding granitic rocks supplying the heat. Isotopic age dating by Turek et al. (1982, 1984) indicates that the external granitic rocks are younger in age than the supracrustal rocks which would be consistent with the model proposed by Ayres (1978).

As one traverses north towards the contact, greenschist facies rank rocks characterized by chlorite and carbonate are replaced by rocks containing biotite and little, if any, carbonate. Continuing northward, amphibole appears and at the contact area amphibole may be the exclusive mafic mineral with no recognizable chlorite or biotite. Within the amphibolitic rocks, porphyroblastic red garnet has locally been observed in Abotossaway Township. One outcrop in Abotossaway Township interpreted to be a mafic intrusion contained approximately 40% garnet in crystals exceeding 8 mm. The transition from greenschist facies to amphibolite facies is at a maximum 0.5 to 1.0 km wide.

In southeastern Corbiere Township, the contact metamorphic relations with the external granitic terrane are similar to those observed on the north side of the belt.

The supracrustal rocks in the southeastern corner of Dunphy Township are greenschist facies, which rapidly increase to amphibolite grade near the contact with the external granitic rocks. The increase in metamorphic grade is rapid within 0.5 km of the external contact and some increase in metamorphic grade may be apparent up to 1.0 km from the contact if the garnet porphyroblasts found in some beds are a product of contact metamorphism from external granitic emplacement. The increase in metamorphic grade is readily apparent as chlorite is replaced by biotite and in turn replaced by amphibole as the external granitic contact is approached.

GREENSCHIST CORE

The greenschist core of the Michipicoten supracrustal rocks is characterized by a typical greenschist mineral assemblage. In the field, this assemblage is principally chlorite, sericite, quartz, sodic plagioclase and carbonate. The rocks in most of Abotossaway, Corbiere and Musquash townships are impregnated with carbonate. The rocks in central Leclaire Township appear much less carbonated than those in the other townships but the mineral assemblage remains greenschist facies. A detailed study of the regional greenschist facies of the Michipicoten supracrustal rocks has not been completed. Studemeister (1982) studied the regional metamorphism in connection with his study of the Gutcher Lake Stock and its contact aureole.

The regional greenschist facies is referred to as the chlorite zone by Studemeister (1982, 1983, 1985c). The regional chlorite zone has been superimposed on the Gutcher Lake Stock and its thermal zone of contact metamorphism.

The greenschist facies (chlorite zone) is characterized by albite, muscovite, epidote, ankerite, calcite, quartz, actinolite and chlorite (Studemeister 1982, 1983, 1985c). Accessory paragonite, siderite, sphene, pyrite, magnetite, apatite, tourmaline, leucoxene, chloritoid, and graphite have been reported to be present (Studemeister 1982).

The chlorite is described as a ferruginous perchlorite with 18 to 30% FeO (total Fe) (Studemeister 1982).

The actinolite is described by Studemeister (1982, 1983, 1985a, 1985c) as containing less than 3% Al_2O_3.

Studemeister (1982, 1983, 1985c) identified the epidote as an aluminum-rich pistacite with up to 15% Fe_2O_3. Some epidote is zoned with the iron content increasing from core to rim.

The white mica is dominantly a hydrous phengitic muscovite however some rocks contain paragonite (Studemeister 1982).

The albite is reported to contain less than 2% anorthite (Studemeister 1983, 1985a).

Studemeister (1982, 1983, 1985c) considered the greenschist facies mineral assemblage to be in equilibrium and brought on by a carbon dioxide-rich hydrothermal fluid during regional metamorphism. The mineralogy suggests an upper limit of 450°C and the absence of pumpellyite suggests a lower limit of 325°C at a 2 kb pressure (Studemeister 1982, 1983). The sphalerite, pyrrhotite, pyrite geobarometer as applied to mineralized veins of the Gutcher Lake Stock indicate a pressure of 1.5 to 3.0 kb (Studemeister 1982, 1983).

The fluid involved in forming the greenschist facies mineral assemblage is of metamorphic origin and of low salinity (Studemeister 1982, 1983). Oxygen isotope data on the minerals failed to indicate either a magmatic or metamorphic origin for the metamorphosing fluids (Studemeister 1982).

Studemeister (1982) has completed the only study which involves examination of regional greenschist facies metamorphism. However, his study covered only a small part of Abotossaway Township.

The author is in closer agreement with the geologic mapping and interpretation of Bruce (1940). The proposal by Studemeister (1982), that the hydrothermal fluid accompanying metamorphism is carbon dioxide-rich, is consistent with field observations of the greenschist facies rocks irrespective of original composition or origin. The abundance of water-bearing micaceous minerals and regionally pervasive soaking of carbonate supports metamorphism via a carbon dioxide-rich hydrothermal fluid as proposed by Studemeister (1982).

The presence of such a high volatile content (water plus carbon dioxide) in the greenschist facies rocks indirectly supports Studemeister's (1982) interpretation of low temperature and low pressure conditions. Studemeister (1982) did not conclude whether the fluid was metamorphic or magmatic in origin. The author has suggested a metamorphic origin (Sage 1987a). The development of the carbonate-rich greenschist facies mineral assemblage is regionally extensive and cannot be spatially associated with a discrete plutonic event which suggests it is related to an independent regional metamorphic event. This regional metamorphic event could be coeval with widespread, post supracrustal, external batholithic granitic and late internal granitic stock emplacement. The supracrustal rocks of the Michipicoten belt contain abundant primary carbonate such as ferruginous dolomite within cycle one volcanism and the siderite facies at Michipicoten iron formation that caps cycle one volcanism. If the root of the Michipicoten supracrustal rocks extends to sufficient depth that devolatilization of the primary carbonate-rich stratigraphy can occur. The upward streaming of these metamorphically derived carbon dioxide-rich fluids may be the agent stimulating greenschist facies metamorphism at the presently exposed higher structural levels. This model was proposed by Sage (1987a) but requires geophysical modeling of the three dimensional aspects of the belt in order to confirm, modify, or reject.

Within this map area, the pervasive carbonate alteration lacks clear spatial association with shear or fault zones. Structural control for the alteration is thus lacking. In addition, carbonate alteration affects all volcanic cycles and all rock types. This latter observation indicates the alteration occurred after supracrustal deposition. Metamorphism may be coeval with deformation and granitic magma emplacement.

METAMORPHISM ASSOCIATED WITH THE GUTCHER LAKE STOCK

Alteration of the stock margins and wallrocks about quartz-carbonate veins are a manifestation of a greenschist mineral assemblage being superimposed on the Gutcher Lake Stock (Studemeister 1982, 1985a). This regional metamorphic event retrograded the contact aureole of the stock (Studemeister 1983, 1985a).

Studemeister (1983) interpreted the veins within and around the Gutcher Lake Stock to have resulted from the precipitation of gold, quartz, and pyrite in fractures in response to cooling and chemical reaction of fluids associated with regional metamorphism.

Greenschist rank metamorphism has imposed a mineral assemblage of chlorite, actinolite, quartz, carbonate and white mica on the stock (Studemeister 1982). The extent of the regional overprint ranges from incipient within the interior of the stock to intense along the margins of the stock (Studemeister 1982).

Studemeister (1982, 1983) interpreted the stock mineralogy to indicate metamorphic disequilibrium. This interpretation is partly based on the presence of zoned plagioclase feldspar with a 15% anorthite core and clear albite rim (Studemeister 1982, 1983). Replacement and pseudomorphism of feldspars by white mica, quartz, calcite, and of biotite by chlorite, calcite and epidote are other mineralogical indicators of disequilibrium (Studemeister 1982, 1983).

The transformation of the outer margin of the Gutcher Lake Stock to greenschist facies mineralogy involves gains in K, H_2O, CO_2, Mn, Rb, Nb and the concomitant loss of Ca, Cl, Sr and Cr (Studemeister 1982).

GUTCHER LAKE STOCK - CONTACT AUREOLE

An envelope of contact metamorphism enclosing the Gutcher Lake Stock is easily recognizable in the field and was the subject of an extensive investigation by Studemeister (1982). Emmons and Grout (1935) recognized the contact metamorphic aureole. The metamorphosed hornfelsed rocks are hard to break, lack pervasive carbonate soaking that characterizes the surrounding terrain, and they have some preserved primary structures that were destroyed by deformation in the enclosing lower grade rocks. The hardness of some of the hornfelsed intermediate to mafic metavolcanic rocks may have prompted some mappers to classify some intermediate to mafic metavolcanic outcrops as felsic (AFRO).

The contact aureole has been referred to as the biotite zone or as epidote amphibolite hornfels (Studemeister 1982, 1983). The zone has had a foliation and zones of cataclasis superimposed upon it (Studemeister 1982) and is up to 1 km wide (Studemeister 1983, 1985a, 1985b).

Studemeister (1982, 1983, 1985a) interpreted mineral relations to indicate the overprinting of a regional metamorphic event on the aureole by fluids associated with regional metamorphism. This regional metamorphism developed a disequilibrium retrograde mineral assemblage (Studemeister 1982, 1983). The mineralogy of the contact aureole is hornblende, epidote, quartz, albite, biotite, dark green hornblende porphyroblasts, chlorite, magnetite, and calcite (Studemeister 1982, 1983). Studemeister (1982, 1983, 1985a) considered the hornblende with actinolite rims, the chlorite replacing biotite, the plagioclase with variable albite (0 to 8% anorthite) and the variable core to rim iron content in the epidote to indicate the assemblage is in disequilibrium. Studemeister (1982) cited the imprint of deformation and the presence of mineral crosscutting relations in support of disequilibrium but such features could have alternative interpretations. Variable mineral compositions cited by Studemeister (1982, 1983) are the strongest support for disequilibrium.

Amygdules within intermediate to mafic metavolcanic rocks commonly have quartz and carbonate fillings, however, within 1 km of the Gutcher Lake Stock these amygdules are filled with amphibole plus quartz (Studemeister 1982, 1983). Studemeister (1982, 1985a) described the amphibole porphyroblasts occupying the amygdules as containing poikilitic inclusions or stringers of quartz, calcite, or chlorite.

The amphibole within the rocks of the contact zone has up to 12% Al_2O_3 and a higher Al, Ti, Na, and K content when compared to the actinolite rim on the amphibole (Studemeister 1985a).

The epidote of the contact zone is an aluminous pistacite with up to 15% Fe_2O_3, and some epidote grains are rimmed with calcite and chlorite (Studemeister 1982, 1983, 1985a). The epidote may have an iron-rich core (Studemeister 1985a).

Studemeister (1982, 1985a) reported that biotite is an accessory mineral in the contact aureole occurring with hornblende, epidote, quartz and chlorite and locally pseudomorphed by chlorite and sphene. Studemeister (1982) reported the biotite to be iron-rich and of uniform composition.

Chlorite coexists with hornblende, epidote, quartz, and biotite and is a ferruginous prochlorite that contains more iron and lower magnesium than the prochlorite of the regional greenschist facies rocks (Studemeister 1982).

Studemeister (1982, 1983) reported that the hornfels contains accessory sphene, apatite, graphite, pyrite, pyrrhotite, chalcopyrite, sphalerite, and cobaltite.

Pillow rims consisting of 20% magnetite plus pyrrhotite were reported by Studemeister (1982, 1983) but this occurrence was not found by the field party.

The hornfels is normally a fine-grained, granoblastic rock which changes texture rapidly near veins that cut it (Studemeister 1982). The changes described by Studemeister (1982) are as follows:

1) Enhanced schistosity followed by abrupt appearance of vein material.
2) Increase in quartz, chlorite, muscovite, pyrite and carbonate towards vein.
3) Decrease in biotite, epidote, and amphibole towards the vein.

The change in texture and mineralogy marginal to the veins occurs up to 3 m from the vein (Studemeister 1982).

On the basis of mineralogy, Studemeister (1982, 1983) proposed that contact metamorphism occurred at 450 to 550°C and pressure of 2 Kb. The metamorphic conditions did not reach amphibolite facies but the biotite subfacies of the greenschist facies is intermediate between the chlorite subfacies and lower amphibolite facies (Studemeister 1982). Imposed on the contact facies, were retrograde conditions of 325 to 450°C at 1.6 to 3 Kb to form epidote, quartz, actinolite, hornblende, calcite, and chlorite.

The fracture zones within the stock consist of zones of foliated quartz, calcite, white mica and chlorite that grade outward into hornfelsed rock veined with quartz, calcite, white mica and chlorite (Studemeister 1985a).

The biotite zone or hornfels was observed by (Studemeister 1983, 1985c) to contain 400 to 4000 ppm Cl (average 1420 ppm) contrasting with less than 300 ppm Cl (average 75) in the outer regional chlorite zone. Studemeister (1982) interpreted the data to indicate a brine participated in contact metamorphism. The chlorine is held in the biotite and hornblende of the hornfels (Studemeister 1985c).

TROUPE LAKE STOCK - CONTACT AUREOLE

An aureole of epidote-amphibole hornfels envelopes the Troupe Lake Stock in Dunphy Township. The hornfels envelope reaches a maximum width of 300 m but is best developed over a width of approximately 100 m. This aureole is easily recognizable in the field in proximity to the stock. The typical light green colour of the greenschist facies rocks becomes dark green to black. The rocks become much harder to break and such minerals as chlorite and carbonate that typify the greenschist facies are visually absent. The Troupe Lake Stock - supracrustal contact is sharp and there is little evidence of large scale chilling of the granitic magma against the supracrustal rocks. Minor disseminated sulphide and sulphide filled fractures are common in the hornfels close to the contact.

METAMORPHISM ASSOCIATED WITH THE MAGPIE-ALICE IRON RANGES

In southeastern Leclaire Township, one iron range consists of massive siderite (Magpie) at one end and massive magnetite (Alice) at the other. The relationship of the massive siderite to the massive magnetite is a problem requiring some additional investigation. Mapping disclosed that the Magpie Iron Range strikes east to Iron Knob where it abruptly turns approximately 90° to strike south along the east shore of Alice and Eva lakes. The sharp change from siderite to magnetite appears to occur at this inflection in strike. Mapping in the area has disclosed a hard brittle series of metavolcanic rocks lower in carbonate content than typical of the area east and south of the iron ranges (Sage 1987c). Traces of garnet in one thin sectioned sample were noted. Mapping has disclosed an outcrop of granitic rock northeast of Alice Lake next to the iron range and a small stock of granitic rock was located at the Holliday-Bingham Pb-Zn-Ag showing 0.8 km east of Alice Lake. The presence of these small granitic occurrences suggests the possibility of a larger granitic mass at depth implying that this area could have been subjected to the higher temperatures of contact metamorphism.

Examination of long abandoned trenches in the Alice Iron Range indicate the presence of branching and oval sulphide structures reminiscent of structures observed in the siderite at the Lucy Iron Range, Chabanel Township (Sage 1987a). This observation indicates that the magnetite had a siderite precursor and is not a primary facies change at the time of deposition.

Taking field observations, very limited thin section examination and observations in other areas of Wawa, it is tentatively proposed that the magnetite of the Alice Iron Range is the metamorphosed equivalent of the siderite found at the Magpie Iron Range.

Thin sections of the dark matrix to the volcanic breccia below the Alice Iron Range indicate abundant euhedral magnetite, perhaps as much as 20% of the matrix. Sage (1987a) described the abundance of siderite in the tuffs underlying the Helen Iron Range and other iron ranges near Wawa. Metamorphism of this disseminated footwall siderite would give rise to this disseminated magnetite in the breccia matrix of the footwall breccia.

DIABASE DIKE - CONTACT METAMORPHISM

Diabase dikes are numerous in the map area. Invariably where these dikes traversed low grade, greenschist facies, volatile-rich assemblages an extensive hornfels zone was developed. The rock is hard, brittle, and flinty when hornfelsed and dikes can be easily traced where not exposed if sufficient outcrop of hornfelsed rock exist.

At the Magpie Mine, a diabase dike cuts the siderite and considerable magnetite developed in the hornfelsed zone. This zone of magnetite is approximately 25 feet wide on both sides of the dike (Leith 1916b). At the Ruth Iron Range, magnetite is formed from siderite to a width of 17 m from a 50 m wide dike (Richter 1952). At the Helen Iron Range, magnetite-bearing contact zones 1.6 to 8.3 m wide form in the siderite where cut by diabase (Canadian Mining Journal 1956).

INTERMEDIATE TO FELSIC METAVOLCANIC ROCKS WITH CHLORITOID

Chloritoid in intermediate to felsic metavolcanic rocks is common in the map area. The principal area for chloritoid development within intermediate to felsic metavolcanic rocks lies west and northwest of Alden siding on the Algoma Central Railway, in the northeastern corner of Corbiere Township and southwestern corner of Abotossaway Township. Smaller areas of chloritoid development within intermediate to felsic metavolcanic rocks occur in the Reau-Mary lakes area, below the Rand No.2 Iron Range and as small isolated patches in association with iron formation in Corbiere Township. A detailed summary of research on chloritoid was given by Sage (1987a).

In the field, the chloritoid occurs in crystals up to 1 mm and rarely to 2 mm. The chloritoid-bearing rocks are pervasively impregnated with carbonate, schistose, and weather orange brown, yellow brown, to rusty brown. On fresh surface, they are pinkish buff, buff, and pale pink. In hand sample, they appear to be sericite-rich.

The chloritoid crystals are randomly oriented and in bright sunlight impart a sparkle to the outcrop surface.

The distribution of chloritoid-bearing rocks in the region of Alden Lake is the largest such area of chloritoid-bearing rocks so far uncovered in the mapping of the Wawa supracrustal rocks. In the Alden Lake area, the chloritoid occurs within intermediate to felsic and intermediate to mafic metavolcanic rocks and rarely within intermediate to mafic intrusions. In the Alden Lake area and in other areas, the relationship of the chloritoid zones to the presence of iron formation is not apparent.

The large area of chloritoid development may reflect the presence of the Alden Lake Anticline in which folding may have doubled the thickness of the chloritoid alteration zone.

The zones of chloritoid alteration are crudely stratiform and not pipe-like in form. The original alteration giving rise to compositions favourable to chloritoid development is considered to be essentially synvolcanic resulting from circulating volcanic-related hydrothermal fluids (Sage 1987a). These altered volcanic rocks were then folded. The chloritoid was then formed in response to a regional metamorphic event that took place during and shortly after the late stages of folding. The chloritoid porphyroblasts are dominantly undeformed and randomly oriented, however, some specimens display chloritoid that has been sheared and kinked indicating that locally deformation, overlapped chloritoid formation.

In thin section, the chloritoid-bearing intermediate to felsic metavolcanic rocks display an porphyroblastic seriate distribution of chloritoid set in a fine-grained granoblastic matrix. The mode is estimated at 10 to 50% chloritoid, 5 to 30% carbonate, 5 to 25% sericite, and 25 to 70% matrix. Accessory epidote, chlorite and opaques occur in trace to very minor amounts. In a sample of chloritoid-bearing feldspar crystal tuff, highly altered plagioclase crystals had a composition of An8.

The chloritoid displays ragged prism faces and sharp basal (001) faces. Good polysynthetic twinning occurs parallel to the basal plane. The ragged ends of some crystals are swallow-tail like. The crystals are poikiloblastic and contain inclusions of quartz, carbonate and possibly untwinned plagioclase. The chloritoid generally occurs as random isolated crystals and as radiating aggregates of crystals. It generally is scattered throughout the rock but in some areas it has been observed to be concentrated in bands.

The sericite imparts a schistosity to the rock. Rarely the sericite may occur as radiating aggregates.

The carbonate is fine-grained and interstitial.

The matrix is a granoblastic mixture of quartz and untwinned plagioclase with considerable very fine-grained sericite and carbonate.

A large group of intermediate to felsic metavolcanic rocks containing chloritoid were selected for complete rock chemistry. These chemical data were plotted on an AFM diagram and a cation plot (Figures 18 and 19). The data displayed a pronounced shift towards iron enrichment and away from normal magmatic trends. The alteration indicates a significant loss of silica, and potassium. The relative increase in alumina is likely the result of removal of the above components and addition of iron which increases the relative alumina content (Table 3). In addition, to higher iron content, the altered rock displays an increase in calcium and carbon dioxide and a decrease in potassium content (Table 3). The chemical data for this suite of rocks is given in the appendix of this report. Sage (1987a, 1987c) gives additional data on chloritoid in intermediate to felsic metavolcanic rocks.

INTERMEDIATE TO MAFIC METAVOLCANIC ROCKS WITH CHLORITOID

Chloritoid in pillowed to massive intermediate to mafic metavolcanic rocks is common in the map area. The most extensive area of chloritoid development within intermediate to mafic rocks occurs at the top of cycle one volcanic rocks in Corbiere Township. At this location, the chloritoid zone extends from the area south of Parks Lake to Siderite Lake a distance of 9.6 km and has a maximum width on the order of 80 m.

Chloritoid in pillowed intermediate to mafic metavolcanic rocks is common above the Rand No.2 Iron Range and in numerous areas within in Corbiere Township.

The chloritoid below the Josephine Iron Range at the top of Cycle one intermediate to mafic metavolcanic rocks has been studied by Worona (1982) and Lockwood (1983). The results of this work was summarized by Sage (1987a). Worona (1982) proposed a 5 step process in forming the mineralogy and fabric of these rocks:

1. Metasomatic alteration of primary rocks and development of schistose texture.
2. An early period of minor pre-chloritoid structural deformation.
3. Chloritoid development.
4. Carbonate development.
5. Minor later post-chloritoid structural deformation.

Lockwood (1983) reported a mineral assemblage of chloritoid + quartz + siderite + ankerite + chlorite + muscovite + paragonite ± pyrite ± hematite ± magnetite ± ilmenite ± zircon ± sphene. The initial concentration of Al and Fe in the altered volcanic rocks is the product of seawater-basalt interaction which precipitated Mg, Si, CO2, Na, K and leached Ca, and Mn (Lockwood 1983). He proposed that smectite and possibly chlorite, anhydrite, magnetite, saponite, caladonite and calcite are the products of this early alteration.

Lockwood (1983) considered chloritoid distribution to be controlled by original rock permeability. Random distribution of chloritoid in flow centres and pillow cores represent low water/rock ratios. Pillow selvages and fracture controlled-chloritoid represents higher water/rock ratio. The random occurrence of chloritoid results from diffuse nonfocused flow. Chloritoid is interpreted to have grown at the expense of chlorite and minor mica which in turn developed from smectite created by seawater-basalt interaction. The chloritoid formed in response to greenschist facies regional metamorphic conditions imposed on the altered rocks. Lockwood (1983) reported three periods of deformation; one before, and two after chloritoid formation.

Chloritoid-bearing intermediate to mafic metavolcanic rocks are characteristically carbonate-rich. Weathering of these altered rocks give rise to yellow-brown, orange-brown, and rusty brown colours similar to the weathering of the intermediate to felsic metavolcanic rocks. In spite of the high degree of alteration, primary textures are commonly well preserved. Mapping and outcrop subdivision therefore depends on the recognition of primary textures which can be interpreted as representing a given precursor rock composition. Outcrops displaying relict pillow selvages were always placed in the intermediate to mafic group. Pervasively altered pillow structures at the Rand No.2 Iron Range and at the top of Cycle one volcanic rocks below the Josephine Iron Range were so well preserved that facing directions based on pillow shape could be determined.

On fresh surface, the intermediate to mafic metavolcanic rocks have similar colours to the intermediate to felsic rocks with green tints common. Chlorite is generally more abundant than in the felsic suite.

The rock texture is very fine-grained, porphyroblastic seriate with a granoblastic matrix. The chloritoid porphyroblasts were hiatal in one specimen. The mode was estimated as 15 to 50% chloritoid, 25 to 40% carbonate, 5 to 10% sericite and 10 to 85% matrix. Accessory epidote, chlorite, and opaques were noted. With the exception of chlorite, the accessory minerals are present only in trace amounts.

The chloritoid forms euhedral crystals with ragged ends some with swallow-tail ends. The crystals have sharp (001) faces that parallels both cleavage and parallel well-developed polysynthetic twinning. The chloritoid porphyroblasts poikilitically enclose blebs of quartz, carbonate, and possibly untwinned plagioclase.

The carbonate is anhedral, disseminated and seriate.

Sericite imparts a strong schistosity to the rock. The matrix is a fine-grained mosaic of granoblastic quartz and untwinned plagioclase with disseminated sericite and carbonate.

Chloritoid-bearing intermediate to mafic metavolcanic samples were selected for complete rock analysis and the data plotted on AFM diagrams and cation plots (Figures 20 and 21). The data indicate that rock compositions are iron-rich when compared with intermediate to mafic metavolcanic rocks of the adjoining map area. Since the original rock compositions are also iron-rich, this shift is not as apparent as where the precursor is intermediate to felsic in composition. The shift to more iron-rich compositions appears to be related to the conversion of Fe_2O_3 to FeO and relative decrease in amounts of SiO_2, Na_2O, MgO, and CaO_2 which increases relative total iron content in the rock. The altered chloritoid-bearing rocks display a significant real decrease in MgO, CaO, Na_2O, and possibly TiO_2 with respect to unaltered metavolcanic rocks. Potassium and carbon dioxide have been added to the altered mafic rocks.

These data are presented in Table 4 which compares chloritoid-free intermediate to mafic metavolcanic rocks in the map area to the south (Sage 1987a) with chloritoid-bearing samples from this map area. The chemical data for the rock suite within this area are presented in the appendix of this report.

MAFIC INTRUSIONS WITH CHLORITOID

Chloritoid has been observed to occur within intrusive quartz diorite. The occurrence is uncommon, if not rare, when compared to its presence within extrusive volcanic rocks. One specimen of chloritoid-bearing intrusive rock from Corbiere Township was examined in thin section.

In thin section, the texture is fine-grained porphyroblastic seriate with a granoblastic matrix. The mode was estimated as 35% chloritoid, 15% quartz, 35% carbonate, 10% sericite, and 10% matrix. Trace accessory opaques are present.

The chloritoid porphyroblasts displayed the customary ragged prism faces and numerous poikilitic inclusions of carbonate plus quartz. Some crystals were fractured. Some crystals occur in random orientation, while other crystals occur in radiating clusters. Quartz is present as anhedral interlocking grains. Carbonate forms an interlocking mosaic. Several grains displayed an outer rim of iron oxides which could be siderite that has undergone alteration.

The sericite defines a schistosity for the rock.

The matrix consists of a granoblastic mosaic of quartz and untwinned plagioclase with associated carbonate and sericite.

Chloritoid alteration within intermediate to mafic intrusive rocks is relatively rare. Three such samples were collected and analyzed. The data is plotted on AFM diagrams and cation plots (Figures 22 and 23). The sample population is too limited for interpretation but the response to alteration appears similar to that for intermediate to mafic metavolcanic rocks.

TOURMALINE-BEARING INTERMEDIATE TO MAFIC METAVOLCANIC ROCKS

In an area of approximately 1.6 by 1.6 km located west and southwest of West Andre Lake, in Musquash Township, tourmaline is present within cycle two intermediate to mafic metavolcanic rocks. The tourmaline occurs in irregular patches. Tourmaline is not restricted to a discrete stratigraphic unit or to a recognizable geologic structure. Tourmaline occurs evenly distributed throughout some units but generally displays a strong preference for pillow selvages and fractures (Plates 9 and 10).

The author interprets the fractures as possible cooling cracks since they lack trends similar to shears and faults found in the area. The author considers the boron alteration to be an early post-consolidation event possibly due to the circulation of boron-bearing heated seawater.

Quartz veining associated with the tourmaline was not observed by the author but subsequent detailed work by Taal (1986) uncovered quartz veining with some tourmaline alteration.

In outcrop, the tourmaline occurs as black prismatic euhedral crystals that can approach 3 cm in length but commonly are 1 cm or less. The tourmaline occurs in isolated crystals and in radiating clusters and aggregates. The crystals weather in relief, are randomly oriented, and are easily recognized in the field.

A limited number of thin sections were prepared. The texture is fine-grained, porphyroblastic seriate with a granoblastic matrix. The mode is estimated as 10 to 20% tourmaline, 20 to 30% carbonate, and 50 to 70% matrix.

Tourmaline occurs as euhedral, poikiloblastic crystals with ragged ends. The tourmaline contains inclusions of carbonate and possibly sericite. Some crystals may be skeletal. The tourmaline is pleochroic in green to brown with darker colors on crystal rims suggesting the crystals are compositionally zoned. The crystals are not fractured nor do they display evidence of recrystallization.

Carbonate is fine-grained and interstitial.

The matrix consists of chlorite, sericite, carbonate, quartz, and untwinned plagioclase. The quartz and plagioclase is granoblastic. Fine-grained chlorite is a major matrix component while sericite is minor. Traces of opaques and possibly epidote were present in one sample. The lack of fracturing and recrystallization combined with random orientation of matrix minerals implies syn- to posttectonic growth perhaps in response to regional metamorphism of previously altered massive and pillowed volcanic rocks.

Taal (1986) reported that the intermediate to mafic metavolcanic rocks are tholeiitic in composition and his data are given in Table 5. The sample locations are given on the accompanying compilation map. He reported that the original volcanic mineralogy was replaced by actinolite, chlorite, epidote-clinozoisite, albite, saussurite, and traces of sericite and this was largely confirmed by the author. Taal (1986) observed that the tourmaline overgrows epidote and that minor quartz plus albite is after plagioclase. He suggested that the lack of reaction rims on the tourmaline also supports a syn- to posttectonic growth.

However, in the authors opinion, the presence or absence of such reaction rims would not conclusively establish syn- or post-tectonic growth.

The folding of at least one quartz tourmaline vein suggested to Taal (1986) that some tourmaline was pre-deformation, however, this deformation could represent a minor late reactivation of older structures related to earlier major regional deformation. Faulting of diabase dikes in the region indicates a late period of tectonic activity. Taal (1986) proposed that the tourmaline in pillow selvages and fractures represent two periods of mineralization, however, the author did not observe field relations supporting the two-stage model.

Taal (1986) reported microprobe chemistry on the tourmaline crystals which is given in Table 6. The major element totals are approximately 86% and the remaining oxides according to Deer et al. (1966) are likely approximately 10% B_2O_3 and 4% H_2O. Taal (1986) found that the tourmaline crystals contain greater Fe in the core than rim and greater MgO in rim than core. The tourmaline is a Mg-Fe rich dravite-schorl with a composition closer to schorl. With the exception of the quartz tourmaline veins Taal (1986) found the tourmalines to have relatively homogeneous compositions. Taal (1986) reported the associated chlorite to be iron rich.

In the zinc-rich portion of the Kidd Creek massive base metal sulphide deposit, Slack et al. (1986) found iron rich tourmaline which appears analogous to the tourmaline described by Taal (1986) in Musquash Township (Table 6). Slack et al. (1986) observed that the Kidd Creek tourmaline had an iron-rich core and more magnesium-rich rim which is identical to that of the Musquash Township tourmaline. In the case of the Musquash Township tourmalines, there appears to be no association with massive base metal sulphides.

The concentration of tourmaline in pillow selvages and along fractures indicates permeability control. Taal (1986) concluded that since the tourmaline was restricted to only a small part of the Michipicoten supracrustal rocks it is not likely that the boron is related to hydrothermal alteration associated with volcanism. He also concluded that the source of the boron was not likely to be magmatic due to the absence of felsic intrusions in the area.

Taal (1986) suggested that the most likely source for boron was from the leaching of volcanic glasses by metamorphically derived fluids during regional metamorphism. This glass would be concentrated in the pillow selvages and interpillow fillings where a large portion of the tourmaline exists.

If the boron has its source in the glassy rims of pillows as suggested by Taal (1986) one would expect tourmaline-bearing intermediate to mafic volcanic rocks to be widespread within the Wawa supracrustal sequence. Widespread tourmaline alteration was not observed during field work and its relatively restricted area of occurrence in association with anomalous gold would support a hydrothermal model for the alteration.

Tourmaline-bearing intermediate to mafic metavolcanic rocks are not common in the Wawa area. A limited suite of samples of tourmaline-bearing intermediate to mafic metavolcanic rocks was chemically analyzed for minor and trace elements. These data were plotted in a AFM diagram and a cation plot (Figures 24 and 25). On the basis of major element chemistry, the sample suite is typical of intermediate to mafic metavolcanic rocks. Differences do appear in the minor elements. Sixteen cycle two intermediate to mafic metavolcanic rocks above the Lucy Iron Range were analyzed for B and Au for the purpose of comparison with the tourmaline-bearing rocks (Samples 80RPS-0012 - 0031, Sage 1987a). Of the 16 samples, 10 had gold contents of less than 2 ppb, the limit of detection. Of the remaining 5 in which sufficient sample material was available the gold content ranged from 2 to 15 ppb and the mean was 6 ppb.

In the case of boron, 8 samples of the 16 contained boron contents below the limit of detection of 5 ppm. In those samples containing measurable boron, the range was 5 to 49 ppm and the mean was 19 ppm.

In the tourmaline-bearing sample suite analyzed for this report, the mean gold content was 25 ppb and the mean boron content 761 ppm.

On the basis of the limited sample population, the presence of tourmaline may indicate the presence of geochemically anomalous gold contents. The chemical data for the tourmaline- bearing rocks, is given in the appendix of this report.

In comparing other minor elements of cycle two volcanism (Sage 1987a) with the tourmaline-bearing rocks, arsenic appears to be greatly depleted and the rare earth elements Ce, La, and Nd somewhat enriched. Major changes do not appear to be present in the remaining elements.

ALTERED INTERMEDIATE TO FELSIC METAVOLCANIC ROCKS

At the Magpie Mine, in Leclaire Township, the massive siderite lies on the north side of a distinctive coarse intermediate to felsic volcanic breccia which may face north. This breccia unit weathers buff to pink and on fresh surface it is pink mottled with light green. The light green patches representing clast cores are separated by pink areas representing clast margins which enhance the recognizable brecciated pattern to the outcrop. The pink and green areas grade into each other and the clast-matrix contacts are not sharp. The presence of chlorite in the cores of the clasts may indicate a rock composition originally more mafic than present composition would indicate. This unit extends from the diabase dike west of the Magpie Mine to Iron Knob where the iron formation takes a sharp right angle bend to the south to become the Alice Iron Range. This distinctive breccia may underlay the Alice Iron Range but it is a much less altered equivalent breccia. The altered unit may reach a maximum width of approximately 0.4 km. This altered breccia lacks the schistosity that characterizes the supracrustal rocks east and west of the mine.

This unit is well exposed in abandoned railway cuts immediately south of the mine.

This volcanic breccia is very distinctive due to its hard cherty nature. It breaks with a subconchoidal fracture. The tough flinty nature of this breccia suggested to the author that the rock had been extensively silicified (Sage 1983). Subsequent chemical data has not supported this interpretation but has identified a group of calcium and sodium metasomatized rocks. These rocks generally are finer grained than the intermediate to felsic metavolcanic rocks found in this and the adjoining areas (Sage 1987a).

In thin section, the texture is very fine-grained and granoblastic. The mineralogy consists of a very fine-grained mosaic of quartz and untwinned plagioclase with abundant very fine-grained sericite and carbonate. The sericite imparts a very weak schistosity to the rock. Traces of epidote occur as an accessory mineral phase.

The hard flinty rocks below the Magpie Iron Range were sampled for complete rock chemistry to define some of the characteristics of the alteration. The chemical data were plotted on Figures 26 and 27.

The plotted chemical data is relatively indistinguishable from other intermediate to felsic metavolcanic rock suites of the area even though some elemental changes are noted (Sage 1987a). The altered rocks show less silica and more alumina than typical intermediate to felsic metavolcanic rocks. The chemistry shows that the altered rocks of the Magpie Mine Iron Range are depleted in magnesium and potassium and enriched in calcium and sodium with respect to the fresher appearing intermediate to felsic metavolcanic rocks of the adjoining area (Sage 1987a). The chemical data suggest that all compositional changes have taken place in response to an undefined alteration process. The comparison of these chemical data is presented in Table 7.

The most significant difference in the alteration style found at the Magpie Mine and chloritoid-bearing intermediate to felsic metavolcanic rocks is one of iron addition in the chloritoid-bearing rocks.

Lisowyk (1987) completed a study of the rocks below the Magpie Iron Range and determined that the alteration is a product of focused fluid discharge. The fluid is interpreted to be low in alkalies, charged with H^+ and extruded into a seafloor environment during phreatic activity (Lisowyk 1987). Lisowyk (1987) found Al_2O_3, K_2O, CaO, and Sr addition and SiO_2, Na_2O, Fe_2O_3 and CO_2 depletion in the samples he studied. The more altered rocks contained muscovite-paragonite and no albite, while the less altered rock contained muscovite and albite (Lisowyk 1987). The chemical data of the author (Table 7) suggests sodium addition and potassium depletion. The issue of sodium and potassium depletion or addition requires more study but is dependant on site sampling and the choice of sample suite to which one compares the Magpie samples.

STRUCTURAL GEOLOGY

The structure of the map area is an extension to that found in the area to the south (Sage 1987a). The oldest easily recognizable deformation is faulting and shearing dominantly of a strike-slip nature which the author considers consanguineous with regional deformation that produced the large fold structures such as the Centre Anticline and Alden Lake Anticline.

If the two iron formation units of Rand No.2 Iron Range and Big Lake and Cline Lake iron ranges are the same stratigraphic unit, there must have been an early period of thrusting which repeated the stratigraphy prior to regional folding. This thrusting and stacking of the stratigraphy is required if the rock units are repeated and now appear as conformable stratigraphy in the fold structure.

Following strike-slip or thrust faulting and subsequent folding the supracrustal rocks underwent a period of left-lateral transverse faulting. These transverse faults have a northwest strike and are represented by relatively straight lines indicating formation that was post folding. In the southern part of the map area, evidence for these faults is easy to recognize due to lithologic offset. However, to the north, the faults become ever increasingly harder to recognize due to ever decreasing lithologic disruption.

The transverse faults are commonly occupied by diabase dikes and in some cases such as the Marsden Fault Zone, the fault zone contains as many as 6 closely spaced parallel diabase dikes.

At least one period of post diabase dike movement is recognizable in the Josephine Mine area, Corbiere Township. Minor reactivation of strike-slip or thrust fault planes within the metavolcanic rocks has locally offset and segmented several diabase dikes in the area at the Josephine West Extension Iron Range.

The author considers some deformation within the Michipicoten supracrustal rocks as likely tied to the development of the Kapuskasing Structural Zone even though solid geologic data supporting such an interpretation is tenuous (Sage 1987a).

The lake systems within the map area generally reflect strong bedrock control and linear strings of lakes and swamps commonly outline the trace of transverse faults.

Studemeister (1982) has suggested that the supracrustal rocks in Abotossaway Township were subject to a north-south compression in which the Gutcher Lake Stock behaved as a competent rigid block. The area examined by Studemeister (1982) is too limited to propose a model for deformation of the entire Michipicoten supracrustal sequence, however, it begins to constrain some of the modeling. Compression was likely part of the stress system on the Michipicoten supracrustal rocks but this was likely accompanied by a thrusting movement to generate the strike-slip or thrust faults and shearing and the recumbent stratigraphy found on the south limb of the Centre Anticline. The author concurs with Studemeister (1982) that the Gutcher Lake Stock most likely behaved as a competent rigid block. The enveloping supracrustal rocks would form a ductile medium in which the massive competent granitic stocks would set.

On the basis of pillow shape, the intermediate to mafic metavolcanic stratigraphy faces north in Dunphy Township. Southwest of Troupe Lake one pillowed outcrop indicates a south facing sequence. This occurrence of south facing rocks was originally found by Bruce (1940) and confirmed by this field party. A minor, but undefined, fold likely exists southwest of Troupe Lake.

On the basis of grain gradation within individual metasedimentary beds in Dunphy Township is often conflicting but the better preserved examples appear to be consistently north. The metasedimentary rocks are thus conformable with and facing in the same direction as the metavolcanic rocks. The supracrustal rocks face north towards the granites as suggested by Goodwin (1963). The supracrustal stratigraphy within Dunphy Township faces consistently north and is likely relatively unfolded with the exception of the area southwest of Troupe Lake.

STRIKE-SLIP FAULTING

Strike-slip faulting represents the earliest period of faulting and is considered by the author to have occurred prior to regional folding. The strike-slip or thrust faults on a local scale appear conformable to stratigraphy, however, regionally they commonly cut across the stratigraphy at an oblique angle. The most spectacular example of this change in fault style is the sharply defined transverse Bauldry Lake and Goetz Lake faults. These two faults join at West Andre Lake, Musquash Township and to the northwest become strike-slip or thrust faults along the south limb of the Centre Anticline. This strike-slip movement along the south limb of the Centre Anticline follows earlier strike-slip faulting that occurred before folding of the supracrustal rocks.

Gledhill (1927) observed that the granitic rocks to be conformably enclosed by schistose rocks and that shearing is dominantly east-west. He thought that faulting parallel to the strike of the schistose rocks was highly likely. In this case, the felsic intrusions acted as resistant knots in a more easily deformed ductile stratigraphy.

Reactivation of strike-slip faulting likely occurred at some unknown time after diabase dike emplacement. Offset on diabase dikes of up to 266 m occurs along low angle oblique strike-slip faults at the west end of the Josephine Iron Range, Corbiere Township. An inflection in a diabase dike trend at a portage between two unnamed lakes northeast of Middleton Lake, Abotossaway Township, also support late reactivation of strike-slip faulting.

NORTH CONTACT FAULTING

The granitic rocks along the northern granitic-supracrustal contact display recrystallized podiform quartz and feldspar. Locally, these granitic rocks may have the appearance of protomylonite to mylonite. The lack of outcrop inhibits interpretation but it is likely that strike-slip movement has occurred along this contact. This movement was likely superimposed on an original intrusive contact since existing U-Pb isotopic ages suggest that the external granitic rocks are younger than the supracrustal rocks. Granitic rocks north of the north contact were dated by U-Pb techniques as 2662±5 Ma establishing a maximum age for this deformation (Turek et al. 1984).

NORTH MIDDLETON LAKE FAULT

Alignment of a series of shallow unnamed lakes north of Middleton Lake defines a northeast-trending lineament. Mapping by the field party indicated an inflection in diabase dike trend and local brecciation of the diabase at the portage between two small unnamed lakes northeast of Middleton Lake. This inflection in diabase dike trend suggests late movement along this proposed fault.

MALL LAKE - MIDDLETON LAKE FAULT

Schistose and fissile rocks at the east end of Mall Lake and a topographic lineament that continues through Middleton Lake, and then through East Middleton Lake may reflect another northeast-striking strike-slip fault. This fault may join with the North Middleton Lake Fault east of East Middleton Lake and continue to the northeast. Topographic lineaments often occupy small lakes and swamps between Middleton and Mall lakes and may represent splays off the main fault. Feldspar porphyry dikes display serrated margins as a result of shearing along this fault trend (Plate 11).

PERRY, SELKIRK, DOHERTY LAKES FAULT

Perry, Selkirk, and Doherty lakes occupy a prominent topographic lineament south of the Gutcher Lake Stock. The rocks north of this lineament are more deformed than those to the south. Original structures are sufficiently well preserved in outcrops along the south shores of the lakes that they can sometimes be used to determine stratigraphic facing directions but north of the lakes the outcrops are generally too deformed to determine facing direction. This structural contrast across the lakes combined with a strong topographic lineament is interpreted by the author to indicate the presence of a strike-slip fault along this lineament trend defined by the lakes.

RAND NO.2 FAULT

At the Rand No.2 Iron Range property, there are two bands of iron formation stacked on top of each other. East of McVeigh Creek, the iron formation is characterized by tight isoclinal folds with long attenuated subparallel limbs. This tight folding becomes more pronounced to the west towards the McVeigh Creek Fault. At the Rand No.2 Iron Range, the north band represents the eastern extension of the south band cut by a low angle oblique fault and thrust over the south band. This suggests an east-west thrust motion. The proposed fault zone represents the sheared out limb of a possible "S"-type fold.

MILDRED LAKE FAULT

The Mildred Lake Fault is a prominent southeast striking transverse fault in the area south of Musquash Township. This fault has a left-lateral offset of approximately 3533 m where it separates the Lucy and Eleanor iron ranges. In northern Chabanel Township, the Mildred Lake Fault becomes a strike-slip fault parallel to stratigraphy and this relationship extends northwest into and across Musquash Township. In Musquash Township, the trace of this fault is a northwest-striking topographic lineament.

MAGPIE RIVER FAULT

The eastern extension of the Magpie River Fault passes through Parks Lake and along the north side of the Josephine-Bartlett Iron Range, Corbiere Township. The faulted western extension of this fault has been described by Sage (1987a). The fault separates a dominantly southeast-striking rocks from northeast-striking rocks at its west end and is conformable to lithologic trends at its east end where it separates a north-facing lithologic package from a south-facing lithologic package. The rocks along the fault are schistose and commonly heavily carbonated. Moore and Armstrong (1946) stated that the presence of faulting that the author refers to as the Magpie River Fault. Moore and Armstrong (1946) described the faulting beneath Parks Lake as accounting for gaps in the iron formation, brecciation and the presence of hematite in the iron formation at the position normally occupied by the siderite.

A prominent lineament between Endless and Cliff lakes north of Parks Lake is probably a splay off the Magpie River Fault. Moore and Armstrong (1946) reported offset on a diabase dike across this fault.

A second splay of this fault is likely represented in the prominent east-trending topographic lineament striking eastward at the southeast corner of Parks Lake. This lineament appears dominantly strike-slip in offset, but locally at Parks Lake it is an oblique fault.

The Magpie River Fault is a group of subparallel anastomosing faults with local splays.

EVANS CREEK FAULT

Evans Creek occupies a prominent lineament parallel to stratigraphy in northern Leclaire Township. The rocks are schistose along this lineament and the author suspects a strong fault-shear zone in the vicinity of the creek bed. The west end of this fault probably curves south and eventually passes out of the map area to the west. Since there are no marker horizons along this lineament, offset cannot be determined. The author suspects movement along this fault to be relatively large, perhaps many kilometres if the stratigraphy forming the Centre Anticline has been infolded into the core of the Michipicoten supracrustal belt. The mafic metavolcanic rocks on both sides of the fault are likely the product of second cycle volcanism, however, the stratigraphy is not continuous and the rock units have been juxtaposed tectonically. Goodwin (1953) recognized this shear-fault and placed it just south of Evans Creek. The author concurs with the interpretation of Goodwin (1953).

IRIS LAKE FAULT

A pronounced topographic lineament exists along Iris Lake and the author concurs with Bruce (1940) that this lineament is likely a strike-slip or thrust fault. The lack of a marker horizon prevents identification of this linear as a fault. The Iris Lake Fault cannot be traced southwest into Abotossaway Township or eastward beyond Smithy Lake.

STRIKE-SLIP FAULTING - SUMMARY

The south limb of the Centre Anticline has undoubtedly undergone considerable tectonic adjustment during folding and overturning. Most of this adjustment likely took place along lithologic contacts and is now largely unrecognizable except for the well developed schistosities observed between various rock units.

In addition, the Goetz Lake and Bauldry Lake faults join at West Andre Lake and become a strike-slip or thrust fault along the south limb of the Centre Anticline. The combined left-lateral offset on these two faults in the area to the south is approximately 1433 m (Sage 1987a). This movement is unrecognizable on the south limb of the Centre Anticline where faulting parallels stratigraphy.

Repetition of iron formation and some assemblages on the south limb of the Centre Anticline are thought to represent tectonic stacking or thrusting which proceeded attenuation that accompanied folding as the Centre Anticline formed.

At the Magpie Mine, unresolved structural complexities occur. On the basis of stratigraphy (coarse intermediate to felsic volcanic breccias south and east of the iron formation), the Alice Iron Range and to some degree the Magpie Iron Range would appear to face north to west which is opposite to what would be expected by its position on the south limb of the Centre Anticline. These iron ranges wrap around a node of relatively undeformed coarse intermediate to felsic metavolcanic breccia. The rocks northeast and southwest of this coarse breccia are typically schistose parallel to lithologic trends implying deformation was deflected around these coarse breccias. The suggested stratigraphic facing reversal could reflect folding or rolling of the stratigraphy during deformation at the time the Centre Anticline formed. The suggested reversal in facing direction on the basis of rock distribution cannot be confirmed by facing data based on primary volcanic structures within the metavolcanic rocks. Therefore, the nature of the folding and faulting in this area is probably not resolvable.

The only evidence for stratigraphic reversal lies in the intermediate to mafic metavolcanic rocks on the north side of the Magpie Iron Range and intermediate to felsic metavolcanic rocks on the south side of the range. This is not a completely reliable criteria since mafic rocks can occur below the iron formation as described from the Lucy Iron Range (Sage 1987a). The chlorite-rich mafic rocks on the north side of the Magpie Iron Range appear to represent a relatively thin unit since rock chemistry completed after mapping indicates massive metavolcanic rocks of dacitic composition occur a short distance north of the iron formation. Rock chemistry in the Magpie Mine area has established the fact that intermediate to felsic metavolcanic rocks containing 60% or more silica as being present on both sides of the iron range (see appendix this report). The recognition of intermediate to felsic metavolcanic rocks on both sides of the Magpie Iron Range and the fact that intermediate to mafic metavolcanic rocks can occur at the base as well as top of a Michipicoten-type iron formation (Sage 1987a) can be interpreted as indicating the stratigraphy is in fact normal and not folded. This alternate interpretation would require that siderite deposition was interrupted by intermediate to felsic volcanism rather than intermediate to mafic volcanism as previously suggested, if one considers the Reynolds Iron Range to represent the missing upper facies of Michipicoten iron formation not found at the Magpie and Alice iron ranges. Intermediate to felsic metavolcanic rocks are not, however, known to cap Michipicoten-type iron formation in other parts of the Michipicoten supracrustal belt.

Another possibility for explaining the complex stratigraphy of the Magpie Mine area is early thrust which stacked, repeated and perhaps separated the facies of iron formation. This early thrusting preceded the regional folding now outlined by the regional rock distribution of iron formation. This model can account for the rock distribution within the Magpie Mine area that is atypical of the Michipicoten supracrustal rocks of the region and explain the conformable appearance of the stratigraphy which would represent unrelated tectonically juxtaposed units. Additional structural study is required in the Magpie Mine area.

TRANSVERSE FAULTS

A number of transverse faults cut the supracrustal rocks. This faulting is post folding and locally shows limited reactivation where mild brecciation and alteration has locally occurred in the diabase dikes occupying the faults. The transverse faults are commonly occupied by diabase dikes which can be traced for many kilometres across the map area. The dominant dike trend is approximately 330°. Previous mappers have recognized that diabase dikes commonly occupy fault zones (Collins and Quirke 1926; Moore 1931; Bruce

1940; Goodwin 1962). Displacement is almost always left-lateral. The amount of lithologic offset decreases as one moves northward along the transverse faults.

MCVEIGH CREEK FAULT

The McVeigh Creek Fault is a prominent north-south lineament along the eastern margin of the map area. The lineament is occupied by McVeigh Creek and the road bed of the Algoma Central Railway. Just north of Hawk Junction the hills rise in excess of 100 m on each side of the topographic lineament. Vertical and horizontal offset along the fault is difficult to estimate. At the southern end of the fault, offset of the supracrustal-external granitic contact is estimated at approximately 5.0 km or more. Near Goudreau the offset of the Michipicoten iron range as represented on opposite sides of the fault by the Rand No.1 and Rand No.2 iron ranges is approximately 1900 m. Offset across the fault appears to diminish northward. This declining offset to the north has been noted (Thomson 1926; Moore 1931). Moore (1931, 1948) reported 3.5 miles of offset near Hawk Junction and Collins and Quirke (1926) reported 2.0 miles. The author is in closer agreement with Moore (1931).

Near Goudreau, Richter (1952) indicated 5,000 feet of left-lateral offset and Collins and Quirke (1926) estimated 6,000 feet). The author is in closer agreement with Collins and Quirke (1926). North of Goudreau the McVeigh Creek Fault becomes increasingly difficult to trace topographically.

A northwest trending splay from the McVeigh Creek Fault passes east of Alexandra Lake and through Smithy Lake in Dunphy Township. This fault is splayed and two closely spaced faults are present southeast of Smithy Lake. Total left-lateral offset of the north contact on the Troupe Lake Stock by these fault splays is approximately 2100 m.

The vertical movement on the McVeigh Creek Fault is unknown but Bruce (1960) considered it likely that the vertical movement exceeded the horizontal. Richter (1953) reported;

(1) that drag folds plunging at shallow angles to the north implied greater vertical than horizontal movement,

(2) and that regional folds cannot be traced across the fault.

The drag folds described by Richter (1953) could not be located. The use of minor fold axis to indicate that the vertical movement is greater than horizontal movement should be done with caution without independent supporting evidence. The fold axis orientation described by Richter (1953) is however consistent with a dominantly vertical component of movement.

The Goudreau Anticline to the east of the fault and the Alden Lake Anticline west of the fault are likely related. Regional folds can therefore be correlated across the McVeigh Creek Fault. If the regional Alden Lake Anticline west of the McVeigh Creek Fault correlates with the regional Goudreau Anticline east of the fault as proposed here, the exposed widths of intermediate to felsic metavolcanic on opposite sides of the fault vary considerably. The intermediate to felsic metavolcanic rocks forming the core of the Alden Lake Anticline west of the fault are 4.4 km in width and in the core of the Goudreau Anticline to the east the intermediate to felsic metavolcanic rocks are 5.6 km in width. Since a buried rock units in the core of an anticline would tend to increase in apparent width at deeper levels of exposure the greater width east of the McVeigh Creek Fault implies the east side is up with respect to the west side. The secondary foliations are subvertical to vertical and if they parallel original rock units, uplift on the east side would have to be considerable to account for such contrasting widths of intermediate to felsic metavolcanic rocks. The regional fold is unlikely to be ideally isoclinal, since the widths of the exposed intermediate to felsic metavolcanic rocks differ on either side of the fault.

To the south of Hawk Junction, the Agawa River follows the McVeigh Creek Fault giving it a minimum strike length of 70 miles (Moore 1931; Goodwin 1962).

The author could not trace northwest-striking diabase dikes across the north-striking McVeigh Creek Fault. This was noted by Moore (1931) and could be either the result of the nature of dike emplacement or post-dike movement.

At the north end of the McVeigh Creek Fault, rocks with a diabasic texture were mapped as mafic intrusions within the supracrustal sequence. It is possible that a diabase dike has been emplaced in the McVeigh Creek Fault zone and subsequent movement and alteration has made it difficult to separate it from similar appearing Archean intrusions emplaced within the supracrustal rocks.

Southwest of Square Lake in Dunphy Township to the border with Abotossaway Township at least four left-lateral transverse faults with offsets of 300,800,200 and 300 m respectively are located.

The transverse fault with 800 m of left-lateral offset is the northern extension of the Rand Fault mapped in Abotossaway Township or a closely spaced *en echelon* subparallel fault.

RAND FAULT

The Rand Fault cuts off the south band of the Rand No.2 Iron Range to the west. This fault is occupied by a diabase dike trending approximately 330° and is traceable by a prominent topographic lineament. On the basis of geologic mapping and offsets in isomagnetic contours on detailed aeromagnetic maps (AFRO), left-lateral displacement at the western end of the Rand No.2 Iron Range is estimated at 0.4 km. The northern extension of this fault in Dunphy Township offsets the external granitic - supracrustal contact approximately 800 m.

ALDEN LAKE FAULT

A fault zone extends north and south of Alden Lake. South of Alden Lake the rocks are sheared and the fault is occupied by one or more diabase dikes. The fault trends at 330° where it joins the McVeigh Creek Fault approximately 3.2 km north of Hawk Junction but curves and strikes at approximately 350° in Abotossaway Township. Geologic mapping combined with isomagnetic contour maps (AFRO) suggests left-lateral offset of approximately 0.8 km in east-central Abotossaway Township. The fault is represented by a prominent topographic lineament locally occupied by lineament swamps and shallow lakes.

MARSDEN FAULT

The Marsden Fault is perhaps the dominant northwest-trending transverse fault in the map area. In the Big Lake area, the fault zone is occupied by six closely spaced parallel diabase dikes. While offset occurs across each dike the main displacement appears to be represented by the prominent water-filled topographic lineament extending in a southeast direction from Big Lake. A prominent topographic lineament extends northwest from Big Lake passing west of Perry Lake and along the western margin of the Gutcher Lake Stock. The fault is occupied by diabase dikes in the external granites in northeastern Leclaire Township but clear topographic expression decreases northwestward. The Marsden Fault zone strikes at 330° across the map area and joins the McVeigh Fault zone beneath the sand plain at Hawk Junction. Offset across this fault is difficult to establish.

Richter (1953) proposed a left-lateral horizontal movement of 10,600 feet along the fault zone and stated that he could trace structures across it. This across-the-fault correlation is based on the assumption that the Josephine-Bartlett Iron Range west of the fault zone and the East Brook Iron Range east of the fault zone are the same unit. The author, however, correlates the Josephine-Bartlett Iron Range with the Central Brooks Iron Range.

Richter (1952) considered vertical movement across the fault to be minor, however, Goodwin (1962) considered vertical movement to dominate over horizontal movement. Striae on the Marsden Fault zone surface were measured by Goodwin (1962) to plunge 76° south and this was taken by him to indicate a dominant vertical movement. Goodwin (1962) proposed (on the basis of his lineament study) that the east side of the Marsden Fault moved up with respect to the west. The author questions the use of striae to support such an interpretation, however, the author is in agreement with the suggestion of east side up. The author's interpretation is based on the recognition by Percival and Card (1983) that as one moves eastward through the Michipicoten supracrustal rocks that ever increasing depths of exposure within the supracrustal rocks are present. This interpretation requires that vertical movement on the transverse faults be generally east side up across the belt.

The author correlates the intermediate to felsic metavolcanic rocks and iron formation in the Eccles Lake area with the East Brooks Iron Range. If this is correct, a right-lateral offset of approximately 5.2 km is indicated.

The number of diabase dikes emplaced within the fault zone vary along strike. Detailed mapping by Ego Mines Limited (AFRO) indicates wide variations in strike and width of diabase dikes occurring along the west side of the Gutcher Lake Stock. This pinch and swell character of the diabase dikes was confirmed in mapping by the field party. At one site along the west margin of the Gutcher Lake Stock, an epidotized feldspar porphyry diabase dike appeared to be cut by a younger fresh appearing diabase dike. This was the only crosscutting relationship observed on diabase dikes in the map area.

Diabase dikes in the Marsden Fault zone may locally be chloritized and fractured making subdivision from massive flows or intrusions difficult. This fracturing and alteration indicates minor reactivation of the fault planes after dike emplacement.

GOETZ LAKE FAULT

The Goetz Lake Fault separates the east end of the Ruth Iron Range in Esquega Township (Sage 1987a) from the east end of the Josephine West Extension Iron Range. This fault has been referred to as the Josephine Fault (Moore and Armstrong 1946). The fault strikes at approximately 330° to West Andre Lake where it joins with the north-striking Bauldry Lake Fault. Moore and Armstrong (1946) proposed 2600 feet of left-lateral offset on the Goetz Lake fault and mapping by the author indicates a similar value of 2616 feet.

The fault zone is occupied by several diabase dikes that pinch and swell along strike. Diabase dike approaching 66 m in width were observed to pinch out in distances of less than 0.8 km.

BAULDRY LAKE FAULT

The north striking Bauldry Lake Fault separates the east end of the Lucy Iron Range from the west-end of the Ruth Iron Range. The author mapped a left-lateral offset of 1925 feet on the iron ranges and Moore and Armstrong (1946) estimated the offset at approximately 2100 feet. The fault is represented by a prominent topographic lineament and extensive brecciation of the supracrustal rocks. In contrast to most transverse faults, this fault does not appear to be occupied by a diabase dike.

This fault joins with the Goetz Lake Fault at West Andre Lake. Tight minor folds occur in the metasedimentary rocks on the west and north sides of West Andre Lake and may display a prominent closely spaced fracture cleavage. Brecciation and carbonate alteration is common in the area of West Andre Lake.

Where the Goetz and Bauldry lake faults join, the faulting becomes strike-slip along the south limb of the Centre Anticline. Even though the combined offset on these two faults is approximately 1433 m the lack of marker horizons where the Goetz-Bauldry lake faults extends northwest of West Andre Lake, prevents recognition of offset. The lenses of intermediate to felsic metavolcanic rocks, the local repetition of iron formation and the ridges extending northwest from West Andre Lake are likely the result of stacking of the rock units followed by attenuation due to folding and faulting associated with the formation of the Centre Anticline.

JOSEPHINE FAULT

A minor fault occurs along the east side of Parks Lake, in Corbiere Township. This fault was first recognized by W.F. Morrison and referred to as the Morrison Fault (Moore and Armstrong 1946). While most minor faults are not of sufficient importance to warrant discussion herein this minor fault is of historical interest. The intersection of this fault with the Josephine Iron Range and Magpie River Fault marks the site of the cave-in at the Josephine mine that resulted in closure of the mine. This transverse fault may have played a role in forming the Josephine hematite ore body. In addition to fracturing and brecciation of the iron formation, this fault may have permitted groundwater access to the iron formation resulting in oxidation of the siderite to hematite.

This fault trends north and has a left-lateral offset. To the south, this fault likely joins with the Goetz Lake Fault near the boundary of Esquega and Corbiere townships. Offset on the fault is on the order of 25 m on the south side of Parks Lake. The fault continues northward beyond the iron formation. Moore and Armstrong (1946) reported an offset of 60 feet near Endless Lake. Moore and Armstrong (1946) reported that the fault strikes at 355°, dips 85 to 90°W, displays fault gouge and was pre-ore in development.

MILDRED LAKE FAULT

In the adjacent area to the south, the Mildred Lake Fault is a prominent transverse fault (Sage 1987a). The reader should refer to Sage (1987a) for a description of this fault.

CENTRE ANTICLINE AXIAL PLANE FAULT

Michipicoten-type iron formation is offset approximately 200 m along the axial plane of the Centre Anticline, Leclaire Township. Movement is left-lateral along the fault which parallels the schistosity at approximately 290°. The Lund Lake Stock would appear to have been emplaced along the axial plane fault of this fold structure. This axial plane fault separates the Godon Lake Iron Range to the south from the South Evans Creek Iron Range to the north.

FOLDING

Bruce (1940) recognized folding to be early in the geologic history of the history of the Michipicoten supracrustal rocks. Thomson (1926) suggested that folding and granitic intrusion took place concomitantly. Shear zones conformable to shear zones in the adjacent supracrustal rocks cut the Gutcher Lake and Maskinonge Lake stocks so at least some regional deformation post-dates granitic stock emplacement. Bruce (1940) recognized that faulting post-dates granitic emplacement but predates diabase intrusion.

The most rigorous treatment of folding has been by Goodwin (1962) and his naming of various structural features will be retained here.

CENTRE ANTICLINE

The Centre Anticline is one of the more prominent folds in the map area. The fold nose is centered in Leclaire Township and is clearly outlined by the distribution of iron formation. The iron formation outlining this fold can easily be followed on detailed aeromagnetic and electromagnetic maps at the Assessment File Research Office, Toronto. The fold axis has been placed north of the position indicated by Goodwin (1963) and is marked by an axial planar fault. The axial plane of this fold can be traced southeast into the northwest corner of Corbiere Township but cannot be traced east of the Marsden Fault as suggested by Goodwin (1963). To the west, the axial plane probably passes just north of Radford Lake in adjacent Lalibert Township and continues westward. Goodwin (1963) indicated the fold axis to turn southwest striking across stratigraphy and across the axis of his Kabenung-Josephine Syncline but evidence establishing this trend could not be found.

The north limb of the Centre Anticline is vertical to subvertical and primary structures such as pillows, when recognizable, are too deformed to be useful as facing indicators.

The south limb is vertical to subvertical near the axial plane but as one moves southwest the south limb is ever increasingly overturned. In central Chabanel Township, this limb has dips of 30 to 40°NE while the stratigraphy faces southwest and is thus inverted (Sage 1987a). The three dimensional arrangement of the two limbs suggest an east plunging anticline as suggested by Goodwin (1962).

ALDEN LAKE ANTICLINE

The Alden Lake Anticline is centred in the southwestern corner of Abotossaway Township and the northeastern corner of Corbiere Township. The core of this anticline, as with the Centre Anticline and the Goudreau Anticline east of the McVeigh Creek Fault, is occupied by intermediate to felsic metavolcanic rocks.

The metavolcanic rocks and mafic intrusive rocks of the Alden Lake Anticline are schistose and heavily carbonatized. The author correlates the Alden Lake Anticline with the Goudreau Anticline east of the McVeigh Creek Fault. The trace of the fold axis strikes west immediately west of the McVeigh Creek Fault but bends around to the southeast in east-central Corbiere Township. This bend in the axial plane may be due to drag along the Marsden Fault and the movement inferred is east side north. The bent fold axis indicates cross folding has occurred perhaps at the time transverse faulting. The limbs on this fold are thought to be vertical to subvertical. Detailed aeromagnetic and electromagnetic patterns (AFRO), linear topographic patterns, and mapped geology outline the fold structure.

Goodwin (1962) proposed that a west plunging anticline exists between the Cline Lake and Sheldon Lake iron ranges. On the basis of facing data in the metavolcanic stratigraphy, this proposed anticline could not be confirmed.

Moore (1948) recognized an anticlinal structure southwest of Goudreau which he correlated with the anticlinal structure across the McVeigh Creek Fault. The author concurs with Moore (1948) on the correlation across the McVeigh Creek Fault, however Moore (1948) extended the fold to the Helen Mine near Wawa, an extension for which the author has found no evidence.

NORTH RANGE SYNCLINE

Goodwin (1963) has indicated a synclinal fold axis along Evans Creek in Leclaire Township. Goodwin (1962) extended this fold westward to Iron Lake approximately 38 km west of map area and eastward to the supracrustal-granitic contact in Dunphy Township (Goodwin 1963).

Mapping by the field party failed to find stratigraphic facing data supporting the presence of this fold. Goodwin (1963) placed the North Range Synclinal fold axis along Evans Creek which the author interprets as the locus of a major zone of shearing or faulting with the rocks both north and south of this fault likely facing north, but tectonically juxtaposed and thus, a continuous stratigraphic section is not present. Goodwin (1953) interpreted Evans Creek to follow a fault zone and the author concurs with this earlier work.

KABENUNG - JOSEPHINE CROSS SYNCLINE

Goodwin (1963) has placed a synclinal fold axis between Kabenung Lake (west of the map area) and Hawk Junction. This fold axis crosses the Centre Anticline and South Range Syncline axis Goodwin (1963). Facing data on pillow shapes and primary structures in the metasedimentary rocks failed to support the presence of this synclinal fold. The stratigraphy consistently faces southwest and dips northeast.

SHELDON LAKE SYNCLINE

The Sheldon Lake Syncline separates rocks of the Alden Lake Anticline from the north-facing stratigraphy flanking the Hawk Lake Granitic Complex. The fold is substantiated by facing data based on pillow shapes in the metavolcanic rocks and bedding structures in the metasedimentary rocks. The rocks along this fold axis are schistose, carbonated, and the metasedimentary rocks display a well developed fracture cleavage.

Sheldon Lake and a string of small lakes trending to the north reflect bedrock control and crudely outline the position of the Sheldon Lake Anticline.

Goodwin (1963) recognized this fold and interpreted its axis to extend northward where it was correlated with the South Range Syncline east of the McVeigh Creek Fault. The author has failed to identify the South Range Synclinal fold west of the Marsden Fault, in Corbiere Township. Goodwin (1963) placed his South Range Synclinal axis through both Chabanel and Corbiere townships joining it with the Sheldon Lake Syncline. The South Range Syncline as outlined by Goodwin (1963) was not identified in the adjacent area to the south (Sage 1987a) but was suggested to be present north of Michipicoten Harbor by Massey (1985). The presence of this syncline at Michipicoten Harbor is largely based on one piece of facing data (Massey 1985). The Dore Syncline of Massey (1985) is equivalent to Goodwin's (1963) South Range Syncline. Massey (1985) could not trace this fold east of the Trembly Fault and the author did not identify it in the area mapped by Massey to the east (Sage 1987a).

To the east of the McVeigh Creek Fault, mapping in Aguonie and Bird townships has indicated a south-facing stratigraphy (Sage 1987c). The axis of the South Range Syncline, if present, lies south of map area in these townships. Evidence for the presence of the South Range Syncline as originally outlined is weak.

STRUCTURAL GEOLOGY - SUMMARY

A synthesis of the structural geology of the area has been given (Sage 1987a). The supracrustal rocks may comprise a monoclinal sequence deformed by a combination of compression and thrust movement during development of the Kapuskasing Structural Zone. A number of facing directions based on grain gradations suggests the metasedimentary rocks along the northern margin of the greenstone belt face north into the granitic rocks. This is the reverse of what would be expected if the Michipicoten belt is a synclinal sequence of supracrustal rocks.

East of the map area, Bruce (1940) determined that the volcanic stratigraphy consistently faced north, towards the bordering Dore metasedimentary rocks. The author has confirmed the facing observations of Bruce (1940). These data require that any proposed synclinal axis must be placed within the narrow band of Dore metasedimentary rocks that separate the metavolcanic rocks from the external granitic rocks. Bruce (1940) suggested that the Dore metasedimentary rocks were deposited in a syncline between the metavolcanic and granitic rocks. He suggested that folding in the metavolcanic rocks was independent of folding within the Dore metasedimentary rocks and that a unconformity existed at the metavolcanic-metasedimentary contact. The Dore contained volcanic debris and iron formation clasts indicating that they were younger than the metavolcanic rocks (Bruce 1940).

The author has found no evidence of this synclinal fold in the metasedimentary rocks and both the metasedimentary rocks and metavolcanic rocks appear to be conformable and subject to identical deformation. The north-facing rocks are consistent with the Dore metasedimentary rocks being younger than the metavolcanic rocks and thus it is to be expected that they would contain volcanic detritus and iron formation fragments from lower in the stratigraphy. The unconformity, if present, is a paraconformity and there is no evidence that the metasedimentary rocks have different tectonic histories.

The compression and thrusting movement associated with the formation of the Kapuskasing Structural Zone may have influenced the development of the Centre Anticline with overturned south limb. The pervasive strike-slip faulting which may regionally crosscut the stratigraphy was probably generated concurrently with deformation.

Folding and strike-slip or thrust faulting was followed by transverse faulting. This faulting is probably scissor-like with both horizontal and vertical offset decreasing northward. Diabase dike emplacement in these transverse faults may be either synfaulting or much younger in age. The diabase dikes have been mapped as Proterozoic since they are generally fresh and relatively unmetamorphosed but some, perhaps most, could be Archean in age. If they are Archean in age, the relatively linear outcrop pattern of the dikes indicates a relatively stable tectonic environment since.

Post-diabase dike movement is locally recognizable. At the west end of the Josephine West Extension Iron Range, movement oblique to stratigraphy have offset diabase dikes up to 266 m and an inflection in a diabase dike trend at a portage northeast of Middleton Lake also suggests post-dike movement along reactivated earlier strike-slip or thrust faults. Some dikes are also brecciated and altered suggesting post-dike tectonic activity and alteration. The age of this last tectonic activity is unknown.

PETROLOGY

The dominate intermediate composition of the intermediate to felsic metavolcanic rocks for this map area indicates a wider range of compositions than found south of the map area (Sage 1987a). This reflects general absence of free quartz and more chlorite within the intermediate to felsic rocks of the map area. The intermediate to felsic metavolcanic rocks are dominated by feldspar crystal tuffs rather than the quartz feldspar crystal tuffs found in the area to the south (Sage 1987a). As a consequence of the greater variability in rock composition the strongly bimodal nature of the volcanic rocks south of the map area (Sage 1987a) is not as strongly illustrated in this map area.

The Michipicoten supracrustal rocks are all metamorphosed to the greenschist rank and commonly display the effects of alteration caused by contained water and carbon dioxide content. The metavolcanic rock chemistry within the appendix of this report illustrates this high volatile content. Sampling for rock chemistry was done on the least altered rocks which may give a lower overall volatile content than present in the overall supracrustal stratigraphy.

The sample suite analyzed for the intermediate to felsic metavolcanic rocks in this area and within the adjoining areas (Sage 1987a, 1987c) are dominated by phenocryst bearing rocks and crystal tuffs. The rock chemistry therefore represents crystal plus liquid mixtures and not true magma liquid compositions. The metavolcanic rocks in the area to the south display a strongly bimodal character reflecting the compositionally bimodal stratigraphy (Sage 1987a). The inclusion of spherulitic flows and flow banded flows in the suite from the adjoining area (Sage 1987a) is thought by the author to more closely approximate intermediate to felsic magma compositions than the suite from this area.

This sample suite is dominated by feldspar crystal tuffs and feldspar porphyry clasts from coarser breccia units. It is reasonably safe to assume that present rock compositions differ from the magma from which they were derived but the rock chemistry presented is the closest approximation that is presently possible.

The chloritoid-bearing units, which reflect iron and volatile addition and the loss of silica and potassium, are widespread in distribution. The hydrothermal aquifers giving rise to this alteration preceded chloritoid formation and were likely much more extensive in distribution than the zones presently outlined by chloritoid distribution.

Alteration of the coarse volcanic breccias associated with the iron formation was apparent in the Magpie Mine area. As a result, a relatively large suite of metavolcanic samples were taken for major and minor element analysis. These chemical data are plotted on an AFM diagram and a cation plot (Figure 30 and 31).

These rocks are dominantly intermediate to felsic in composition, lack a tight clustering of chemical data, and possibly show some iron enrichment. Metavolcanic rocks that plot as dacite and andesite are common in the area. Preliminary examination of the data suggests that mild sodium and calcium alteration has occurred within some samples when the suite is compared with a suite of samples from the area to the south (Sage 1987a).

The Magpie Mine area may mark an area in which volcanism of intermediate composition has occurred, however, the lack of clustering of chemical data could also indicate that the rocks of more intermediate composition are the product of metasomatism.

A number of random samples were analyzed for major and minor elements but not included in various groupings of rock types. In most cases, these samples simply represent isolated rocks or groupings too small to rigorously treat so, analysis were done for rock classification. These rocks are listed in the appendix of this report.

Sample 82 RPS-0119 plots is a ferruginous dolomite from the carbonate unit occurring between the felsic and mafic portions of cycle one volcanism. Sample 82 RPS-0163 is a highly carbonated mafic lapilli tuff. It is unlikely that the present composition of this sample is analogous to its original composition.

STRATIGRAPHY

The stratigraphy within the map area is similar to that found to the south of the map area (Sage 1987a). Stratigraphic relations established by Sage (1987a) were used in unravelling the structure and stratigraphy of this map area. The only significant modification to this stratigraphy was in the area of the Magpie Mine where the iron formation consists almost exclusively of siderite. The author came to the conclusion that intermediate to mafic volcanism took place before the upper sulphide and chert facies of this iron formation were laid down. This idea was proposed by Young (1953). The upper facies of iron formation is most likely represented by the stratigraphically higher Reynolds Iron Range. The Reynolds Iron Range correlates with the Godon Lake Iron Range and South Evans Creek Iron Range which together clearly outline the fold structure of the Centre Anticline.

Rock chemistry of the metavolcanic rocks at the Magpie Mine indicate that intermediate to felsic metavolcanic rocks occur on both sides of the iron formation of the Magpie Iron Range. The interpreted reversal of stratigraphy at the Magpie Iron Range is based on the recognition of a thin unit of intermediate to mafic metavolcanic rocks on the north side of the iron formation suggesting north-facing stratigraphy which is opposed to a south facing sequence required for normal stratigraphy on the south limb of the Centre Anticline. However, an intermediate to mafic volcanic breccia does form the base to part of the Lucy Iron Range. Therefore ,intermediate to mafic metavolcanic rocks are not exclusive to the top of the Michipicoten Iron Formation. It is possible that siderite deposition was interrupted by intermediate to felsic volcanism before the onset of the intermediate to mafic volcanism. If this alternate interpretation is true, the stratigraphy is in its normal position. Facing and structural data are needed around the Magpie Iron Range before an adequate structural interpretation is possible.

The iron formations form the best marker horizons in the field and with the use of airborne geophysics are traceable for many kilometres. The sulphide facies of the

Michipicoten-type iron formation is particularly easy to trace on airborne electromagnetic surveys and the chert-magnetite iron formations such as the Dreany Iron Range are easily delineated by airborne magnetic surveys.

Other than iron formation, good marker horizons are generally absent.

Locally, the polymictic mafic volcanic breccia that occurs between the mafic and felsic parts of cycle one volcanism forms a distinctive unit that can be traced from Parks Lake to Siderite Lake in Corbiere Township. This breccia contains iron formation clasts in the area south of Parks Lake which are scarce in the type section on Brooks Lake, Chabanel Township to the south (Sage 1987a). Above this breccia unit lies a ferruginous dolomite which is also present between Parks Lake and Siderite Lake. This rusty weathering carbonate unit is easily identifiable in the field but due to pinching and swelling varies widely in width.

On Selkirk Lake, Abotossaway Township and to the northeast, a mafic volcanic breccia unit was encountered (map units 2u and 2w). If a continuity to this unit were established, it could serve as a local marker horizon.

Some intermediate to mafic magnetite-bearing flows in northern Corbiere and southern Abotossaway townships may locally provide good geophysical markers.

In the past, there has been considerable debate about the stratigraphy of the area and it has been recognized as difficult to unravel. Collins (1918) proposed that the intermediate to felsic metavolcanic rocks were the oldest, the iron formations were intermediate and the intermediate to mafic metavolcanic rocks were the youngest rocks in the area. He interpreted the Bartlett Iron Range (the eastern portion of the Josephine-Bartlett Iron Range) to lie within intermediate to felsic metavolcanic rocks, a stratigraphic position unsupported by the present mapping. The supracrustal stratigraphy of the Hawk Junction area was considered unresolvable by Collins (1918).

Deciphering the stratigraphic position of the Dore metasedimentary rocks and possible structural relations between the metasedimentary rocks and metavolcanic rocks has led to additional difficulties as indicated by Bruce (1940) who proposed that an unconformity existed between the metasedimentary and metavolcanic rocks and that these rock units had different tectonic histories.

Intermediate to mafic volcanism follows the Dore metasedimentary rocks in Leclaire and Musquash townships, but it is absent above the Dore-type metasedimentary rocks along the north contact of the metasedimentary and external granitic rocks of Leclaire and Abotossaway townships. If these two area of Dore-type metasedimentary rocks are the same rock unit, there has been a tectonic repetition of the stratigraphy.

Michipicoten-type iron formation predates the Dore Metasedimentary rocks and the present iron range distribution is the result of segmentation by faulting and folding of units once far more continuous than at present. The main Michipicoten-type iron formation unit occurs at the top of cycle one intermediate to felsic metavolcanic rocks and at the base of intermediate to mafic metavolcanic rocks of cycle two. The Michipicoten-type iron formation is an ideal unit for correlation purposes.

In the area along the north contact of the supracrustal rocks, the metasedimentary rocks face towards the granites on the basis of rare grain gradations in thin wacke beds. This supports the model of an originally north facing stratigraphy which has been subsequently severely deformed.

Thomson (1926) observed extensive deformation within the metasedimentary rocks in the Goudreau area and concluded that the relationship between the metasedimentary and metavolcanic rocks was obscure. Thomson (1926) considered the external granitic rocks to be younger than the Dore metasedimentary rocks. This interpretation is now supported by limited existing U-Pb isotope ages on the external granitic rocks (Turek et al. 1984).

Gledhill (1927) placed the metasedimentary rocks at the top of the stratigraphic section and interpreted the shearing and folding within the metasedimentary rocks and metavolcanic rocks to represent the same structural event. This interpretation was supported by the presence the iron formation clasts in the metasedimentary rocks that were most likely derived from the iron formations lower in the stratigraphic section. The author agrees with Gledhill (1927).

Bruce (1940) interpreted the intermediate to felsic metavolcanic rocks of the Goudreau area as older than the mafic metavolcanic rocks and proposed that the Dore metasedimentary rocks was deposited in a syncline at the supracrustal-granitic contact. This interpretation implies folding in the metasedimentary rocks independent of that found within the metavolcanic rocks. Bruce (1940) placed a unconformity at the mafic metavolcanic-metasedimentary boundary and considered the Dore metasedimentary rocks as younger than the mafic metavolcanic rocks since it contains clasts of mafic metavolcanic rocks. The cycle two intermediate to mafic metavolcanic rocks in the Goudreau area are younger than the cycle one intermediate to felsic metavolcanic rocks and represent portions of two distinct volcanic cycles separated by Michipicoten-type iron formation.

No structural disharmony between the metasedimentary rocks and mafic metavolcanic rocks was observed during the present survey. The unconformity, if present, is a paraconformity. In the map area examined by Bruce (1940), metavolcanic rocks were not found above the Dore metasedimentary rocks and the Dore metasedimentary rocks were considered the youngest rock assemblage in the Michipicoten supracrustal belt.

While minor folding does exist within the metasedimentary rocks along the north contact of the supracrustal rocks with the external granitic rocks; the anticlinal, synclinal folding of the sedimentary rocks proposed by Bruce (1940) were not documented by the author. On the basis of pillow shape, the stratigraphy in this map area and in the area to the east (Sage 1987c) faces north conformable with the metasedimentary rocks and the author considers the Dreany Iron Range, which lies close to the metavolcanic-metasedimentary contact, as facing north not south as proposed by Bruce (1940).

Recent mapping by Studemeister (1982) in Abotossaway Township defined a north facing stratigraphy on the basis of pillow shapes and grain gradations in interflow sedimentary rocks. This has been confirmed during present mapping.

To the south of the map area and extending into the map area, Goodwin (1962, 1964) proposed a west to east correlation across transverse faults of the Mildred, Helen, Johnson, Eleanor, Lucy, Ruth, and Josephine-Bartlett iron ranges. The author concurs with this correlation (Sage 1987a). Richter (1952) and Goodwin (1962, 1964), however, correlate the eastern end of the Josephine-Bartlett Iron Range with the East Brooks Iron Range. The author prefers to correlated the Josephine-Bartlett Iron Range with the Central Brooks Iron Range and the segments of iron formation in the Eccles Lake area with the East Brooks Iron Range. The Josephine-Bartlett and East Brooks represent the same stratigraphic horizon, however, the Centre Anticline may represent an infolded portion of the supracrustal stratigraphy that once joined the two segments of Michipicoten-type iron formation. if the eastern end of the Josephine-Bartlett Iron Range correlates with the western end of the east Brooks Iron Range across the Marsden Fault, a thrust movement from regional compression without significant transpression would be required to develop the in-folded stratigraphy of the Centre Anticline.

Goodwin (1962, 1968) suggested that the top few feet of chert in the Reynolds and Godon Lake iron ranges has been weathered. If this interpretation is correct a paraconformity may exist at the top of this iron formation. The upper surface of these iron ranges is likely to have been the locus of shearing, granulation, and brecciation which may be confused with the development of a paleosoil or regolith.

In unraveling the structure and stratigraphy of the Wawa supracrustal rocks, the author considers the Michipicoten-type iron formation with its characteristic siderite and pyrite facies at the stratigraphic base to have once represented a continuous unit representing a period of chemical and clastic sedimentation. The iron formation caps and separates intermediate to felsic metavolcanic rocks at the top of cycle one volcanism from the intermediate to mafic metavolcanic rocks at the base of cycle two volcanism. It is an excellent regional marker for the outlining of folds and determination of fault offset.

Calvert (1982) prepared a detailed stratigraphic investigation of the Josephine Mine area as part of the survey mapping program. The stratigraphic section examined by Calvert (1983) incorporates the upper portion of cycle one volcanism and the upper part of the Dore metasedimentary rocks which have been faulted down onto the Michipicoten-type iron formation by the Magpie River Fault (Figure 33). The stratigraphic section is typical of the Josephine Mine area up to the region of faulting along the top of the Michipicoten iron formation. This faulting is part of the Magpie River Fault Zone.

GEOPHYSICS

Published government aeromagnetic maps covering the map area outline the Centre Anticline and crudely position the various iron ranges (ODM-GSC 1963a, 1963b). The flight lines on this survey are too widely spaced to bring out most of the structural detail.

Aeromagnetic and electromagnetic maps on file with the Assessment File Research Office, Toronto are more useful as the much closer flight line spacing brings out more detail. The detailed surveys clearly define the Centre Anticline, a number of fault zones, and a limited number of diabase dikes. The aeromagnetic surveys do not, however, mark the position or clearly outline some of the diabase dike intrusions.

The sulphide facies of the Michipicoten-type iron formation makes an excellent electromagnetic marker and the magnetite of the North Evans Creek, Alice and Dreany iron ranges give a strong response on aeromagnetic surveys.

Aeromagnetic and electromagnetic surveys giving incomplete coverage for Dunphy Township (AFRO) show many electromagnetic and magnetic anomalies which in most instances can be correlated with iron formation. The isomagnetic contours and electromagnetic anomalies indicate a northeast-striking sequence of supracrustal rocks. The isomagnetic contours also outline the Troupe and Gutcher Lake stocks.

Disruption in isomagnetic contours occur across the northwest trending splay fault that cuts the Troupe Lake Stock and across the northern extension of the Rand transverse fault. The Marsden and McVeigh Creek faults are easily traceable through disruptions of isomagnetic contours.

Gaps in existing aeromagnetic maps for Dunphy Township prevent positive identification of diabase dike trends but there is a suggestion that the diabase dikes mapped at the western end of the supracrustal rocks just above the township boundary give a northwest-trending lineament array of magnetic highs.

ECONOMIC GEOLOGY

The map area has undergone repeat geologic exploration for mineral deposits. The map area is known for its gold and pyrite deposits. One former mine, the Murphy Gold Mine has produced gold. Recent developments at the Magino and Kremzar properties east of the map area are hopeful for the resumption of gold production from the region.

BASE METAL MINERALIZATION

The map area has been extensively prospected for base metals. Acme Gas and Oil Limited, Union Miniere Explorations and Mining Corporation Limited, Amax Minerals Exploration, and Getty Mines Limited have completed programs in search of base metal mineralization. These programs were targeted to identify the source of airborne electromagnetic conductors and have so far been unsuccessful in locating base metal mineralization.

The large volume of sulphide found in the Michipicoten iron formation makes it a target for both base and precious metal mineralization. Collins and Quirke (1926) reported sulphide facies iron formation carrying anomalous Cu, Zn, Ni, and Au. Richter (1952) reported the presence of sphalerite and rare galena in the Big Lake Iron Range and chalcopyrite in the Rand No.2 and East Brooks iron ranges within the map area. During mapping, samples of the iron formation were gathered by the field party and assayed for their base and precious metal content. While the occasional assay may be slightly anomalous, the results are generally not encouraging. Base metal sulphides in the Michipicoten iron formation occur as fracture fillings and do not appear to be an indigenous part of the rock unit. Both precious and base metal mineralization in iron formation appears to be fracture controlled. The Michipicoten iron formation does not appear to be particularly favourable for the presence of syngenetic base or precious metal mineralization. However, in areas where the iron formation is fractured and tightly folded or otherwise suitably prepared structurally for mineralizing fluids the iron formations may be good exploration targets.

The extensive development of chloritoid in the metavolcanic rocks indicates extensive alteration in response to hydrothermal fluids. Metamorphism of the altered metavolcanic rocks with the development of chloritoid crudely outlines these stratiform hydrothermal systems. A select group of chloritoid-bearing cuttings from Superior Acid and Iron Limited drill cores on the Rand No.2 Iron Range and chloritoid-bearing surface samples from the Josephine Mine area were examined for precious metal and base metal contents. The Rand No.2 samples probably represent both intermediate to felsic and intermediate to mafic volcanic precursors while the samples from the Josephine area were intermediate to mafic metavolcanic rocks. The alteration of the Rand No.2 samples was so pervasive that original mafic and felsic compositions could not be identified. The chemical data presented in Tables 8 and 9 indicates no unusual concentrations of either precious or base metal mineralization within chloritoid-bearing rocks.

There is little development of intermediate to felsic metavolcanic rocks within Dunphy Township. There is thus little likelihood that massive sulphide deposits analogous to those found associated with felsic volcanism will be found.

Silver is present at the Bingham-Holliday and Kozak properties within the map area. The silver is associated with galena, pyrite, chalcopyrite, and sphalerite in quartz veins.

IRON DEPOSITS

At least two iron mines once operated in the map area. The Magpie iron mine in Leclaire Township closed in the early 1920s. One of the major factors in closing was the presence of a mafic intrusion that was encountered at depth which cut off the siderite ore body. The reserves at the mine are meager and it does not appear likely that iron ore production will resume from the property.

The former Josephine Mine on the Josephine Iron Range reached depths of 1000 feet. The hematite ore body occurs where two intersecting faults cut the iron formation. The mine caved-in to the 600 foot level in 1946 and lake sediment filled the mine workings. Several million tons of hematite ore remain in the mine, however there would be considerable expense in removing the lake sediment from the mine and the rock problems leading to the initial cave-in would remain. Production of iron ore is unlikely to resume from this mine in the foreseeable future.

Within the map area, all the iron formations of any consequence have been diamond drilled at least once. Geophysical surveys have been flown over the area by several exploration companies and any iron formations of any size have likely been located. However, if pyrite becomes of economic value, the iron formations contain large reserves which could be easily extracted.

Isolated prospect pits in iron formation were located in numerous areas of Dunphy Township but, the iron formation is siliceous and would appear to be too narrow in width and too low in iron content to be of present or near future commercial value.

The best potential for future iron ore production in the map area, would appear to be the Bartlett portion of the Josephine-Bartlett Iron Range which has been extensively drilled. The drilling indicated approximately 30 million tons of siderite ore

GOLD MINERALIZATION

Thomson (1921) was one of the earlier investigators of economic geology in the area. Thompson (1921) divided the gold veins into three groupings:

1) Small quartz veins parallel to schistosity consisting of quartz, carbonate, tourmaline, and the sulphides, pyrite, pyrrhotite, chalcopyrite and galena. These veins occur in all rock compositions and gold values may extend into the wall rocks for short distances.
2) Transverse gold-bearing quartz veins, principally in proximity to the Gutcher Lake Stock and which can be subdivided as follows;
A. sharply crosscutting discontinuous veins that do not impregnate the wall rocks. These veins carry gold where they crosscut the iron formation. However, significant gold is not present in the wall rock of the iron formation.
B. the Murphy Mine fissure vein is a sharply crosscutting vein unique in the area. This vein has a high carbonate contact which may comprise 50% or more of the vein.

Thomson (1921) considered the gold mineralization to be related to the last phase of granitic intrusion since tourmaline occurs within the gold-bearing veins and the most likely source for this tourmaline mineralization would be late stage hydrothermal fluids related to granitic magmatism.

Thomson (1926) and Collins and Quirke (1926) related gold mineralization to felsic intrusion and considered the felsic metavolcanic rocks more favorable hosts than mafic metavolcanic rocks.

Gledhill (1927) examined the gold mineralization in the map area. Gold mineralization was correlated to granitic intrusion since the gold-bearing veins contained tourmaline and display hydrothermal alteration (Gledhill 1927). Gledhill (1927) observed that the dominate gold-bearing vein trend is east and that the veins commonly have a width of less than 3 feet with some veins having mineralization within the walls to the vein. Gledhill (1927) interpreted the veins to occupy fault fissures and to be tabular in form.

The quartz vein mineralization consists of native gold, pyrite, pyrrhotite, sphalerite, chalcopyrite and galena with galena and sphalerite being relatively uncommon (Gledhill 1927). The sulphides do not carry gold and better gold values occur in granulated quartz veins. The presence of better gold values in granulated quartz appears to hold true in the adjacent area to the south (Sage 1987a). However, in the area to the east, some of the richest gold mineralization on the Kremzar property occurs in a non-granular grey cherty quartz (Sage 1987c). The texture of the quartz in a quartz vein therefore cannot be used as a definitive criteria of vein gold content. Gledhill (1927) recognized two generations of quartz in the gold-bearing veins.

Gledhill (1927) recommended prospecting for gold around granitic intrusions and considered the eastern and western margins of granitic stocks the most favourable for gold mineralization since shearing is east. The author found that the north and south contacts where east shearing around the more competent stocks, would likely be most intense. The Gutcher Lake Stock shows a good example of sheared north and south contacts in response to the regional east shear pattern.

Features given by Gledhill (1927) to look for in the search for gold mineralization are:

1) Local bands of intense shearing,
2) Syenite porphyry dikes and fissure veins of quartz,
3) Rusting pyritized schist bands, and
4) Zones of brecciation and crushing with quartz filling.

The syenite porphyry of Gledhill (1927) is likely the feldspar porphyry dikes observed by the author. The author has not observed any obvious relationship of gold mineralization to the feldspar porphyry dikes, however, the remaining three recommendations appear to be valid.

Moore (1931) observed a close association between gold and east shearing and a absence of gold in cross structures. This would suggest that the cross faults are later than the mineralization. However, gold does occur in cross structures east of the map area (Sage 1987c).

Moore (1931) considered the gold deposits to be vein-type, some with sharp contacts and others more or less gradational into the wall rocks. He attributed the mineralization to granitic intrusion.

Moore reported the presence of arsenopyrite and chlorite in the veins. Moore (1931) mentioned that alteration was associated with gold mineralization. He reported carbonatization of the wall rocks and biotite replacement in rocks of intermediate composition. He reported that extensive silicification and sericitization had also occurred.

Sheared intermediate to felsic rocks became sericite schists and gold-bearing veins are present in both sheared felsic and mafic metavolcanic rocks. While most veins are parallel to the schistosity, Moore (1931) reported that some veins cut across strike.

In contrast to Thomson (1926), Moore (1931) considered the mafic metavolcanic rocks to be more favorable for gold. He recommended prospecting near granitic stocks that intrude the greenstone and did not recommend prospecting the large batholithic (external?) granitic complexes. Sheared and brecciated porphyry and granodiorite masses are particularly favorable for gold mineralization (Moore 1931).

Bruce (1940) investigated the gold deposits of the region. He observed the gold veins to be lenticular and associated with shearing, silicification, and carbonatization. Bruce (1940) considered productive veins to occur only in granodiorite (trondhjemite). The gold mineralization occurs in fractures subsidiary to major shears and is developed in rocks of favorable physical character (Bruce 1940). Bruce (1940) proposed that the veins occurred at the top of intrusive bodies or at crests in folds within lava flows. Bruce (1940) reported vein mineralization identical to previous investigations but describes the vein carbonate as iron rich.

Bruce (1940) suggested a granitic magmatic source for the gold based on the clustering of gold veins around granitic intrusions. Such a clustering is apparent around the Gutcher Lake Stock but it does not appear to be valid for the region in general. Bruce (1940) also reported gold mineralization in association with a diabase dike but the author has not observed gold mineralization associated with diabase dike intrusion anywhere in the areas mapped.

GOLD MINERALIZATION - GUTCHER LAKE STOCK

The Gutcher Lake Stock and nearby gold mineralization has been extensively studied in detail by Studemeister (1982, 1983, 1985a, 1985b, 1985c,).

Studemeister (1982, 1985c) reported anomalous Au (10 ppb to 8400 ppb) along with anomalous Ag, Cu, Zn, Co, Ni, and As in the iron formation near the Gutcher Lake Stock. Stratiform sulphide stringers within interlayered mudstones, tuff, clastic breccia and cherty iron formation were considered by Studemeister (1982, 1985c) to have been deposited on the flank of an Archean volcano now represented by the Gutcher Lake Stock. A syngenetic origin was proposed for these sulphides by Studemeister (1985c) because they occurred with layered rocks and cherty iron formation.

The author has not observed the sulphidic muds of Studemeister (1982). The copper-gold mineralization was observed by the field party to be always crosscutting fracture or vein fillings and independent of host rock type.

The mineralized quartz-carbonate veins were extensively studied by Studemeister (1982, 1985b) who described the veins as fractures 20 to 60 cm wide with a west to northwest strike. Chalcopyrite, pyrite, and pyrrhotite are the dominant sulphide minerals and the accessory minerals consist of sphalerite, magnetite, cobaltite, arsenopyrite, tourmaline (schorlite), albite, ankerite, sphene, epidote, apatite, molybdenite and native gold (Studemeister 1982). Veins cutting intermediate to mafic metavolcanic rocks contain chlorite schist fragments. Veins cutting the felsic metavolcanic rocks or the Gutcher Lake Stock contain felsic clasts (Studemeister 1982).

The dominant vein trend is northwest at 135° parallel to apophysis from the Gutcher Lake Stock and Studemeister (1982) divided the veins into simple (quartz plus carbonate) and complex (quartz, carbonate plus schist).

Studemeister (1982) observed that gold bearing veins contain between 5 and 60% sulphide while barren veins contain less than 5% sulphide. Studemeister (1982) also observed that, in general, the gold-bearing veins contain quartz in excess of carbonate.

The alteration of the vein walls is contemporaneous with regional greenschist metamorphism at 325 to 450°C and the gold-bearing veins at the margins of the Gutcher Lake Stock are interpreted by Studemeister (1982, 1985b, 1985c) to be a manifestation of intense retrogression of a trondhjemite intrusion and its epidote-hornblende hornfels aureole.

. Studemeister (1982, 1985b, 1985c) has reached the following conclusions, summarized and condensed for the generation of precious and base metal mineralization at the Ego property, Abotossaway Township;

1) Intermediate to mafic metavolcanic rocks against the Gutcher Lake Stock developed a hornfelsed aureole of pyrrhotite, magnetite, biotite, albite, quartz, epidote, and hornblende during stock emplacement. The aureole resulted in addition of Fe, Mn, K, P, S, Rb, Cl, Zr and removal of Mg, and Cr. The metamorphic conditions were temperature of 450 to 500°C and pressure less than 2 Kb.

The aureole is the biotite subfacies of the greenschist facies.

2) Outside the aureole regional metamorphism converted the rocks to quartz, albite, epidote, calcite, actinolite and chlorite. Regional metamorphism took place at 325 to 450°C and at a pressure of 1.5 to 3 Kb. Rocks are of the chlorite subfacies of the greenschist facies.

3) Retrograde metamorphism of the epidote amphibole contact aureole overprinted a chlorite, calcite, actinolite, muscovite, ankerite, quartz mineral assemblage in the aureole. The retrograde metamorphism introduced H_2O, CO_2 and leached chlorine. Water rock ratios of 3:1 prevailed during retrograde metamorphism.

4) The Gutcher Lake Stock is a massive trondhjemite of quartz and plagioclase overprinted by an assemblage of muscovite, quartz, calcite, ankerite, albite, epidote and chlorite. Metamorphism of the intrusion is mild but along the margin it may be intense.

The metamorphism added Mn, K, Rb, Nb, H_2O, CO_2, and lost Ca, Cr, Sr and chlorine. The changing redox potential suggests that the metamorphism took place at a water to rock ratio of 1:2.

5) Retrograde metamorphism of the stock and its contact aureole overprinted an assemblage of quartz, calcite, ankerite, muscovite, and chlorite. This event added Si, Fe, K, H_2O, CO_2 and Rb and leached Na. The redox state of the iron also changed.

6) The gold-bearing veins contain 5 and 60% pyrite, pyrrhotite, chalcopyrite, and sphalerite. The chlorine content of the veins is less than 300 ppm and the vein walls have underwent sulphur addition. Barren veins have little sulphide and experience only a trivial addition of sulphur.

7) Regional metamorphism and retrograde metamorphism of the epidote hornblende hornfels contact aureole are coeval. Retrograde alteration of stock and formation of gold-bearing quartz and carbonate veins are the result of the same process.

8) Two stage metal deposition about Gutcher Lake Stock account for morphological, mineralogical and chemical diversity. Initial metal deposition is syngenetic copper and gold bearing sulphidic mudstones and iron formation. This deposition was broadly coeval with stock emplacement and development of its contact aureole. This stage evolved into an epigenetic stage synchronous with regional metamorphism. During this period native gold and pyrite were precipitated and pre-existing sulphide minerals were remobilized into fractures crosscutting the margins of the stock and its contact aureole.

9) The layered rocks bearing stratiform and vein concentrations of base and precious metals formed at the stratigraphic top of the Gutcher Lake Stock. The anhydrous mineralogy of the trondhjemite and juxtaposed contact aureole are susceptible to hydration, carbon dioxide fixation, and gold mineralization by metamorphically derived fluids generated during regional metamorphism.

From the conclusions Studemeister (1982, 1985b, 1985c) proposed the following model.

1) Volcanic emanations and chemical sedimentation deposited Au, Ag, Ca, Zn, Cu, Fe, and S bearing layers within a clastic sedimentary series in a trough-like depression on the seafloor.

2) Seawater convection through the volcanic rocks occurred in response to thermal gradients above the rising trondhjemite intrusion. Circulating seawater developed into a hot brine with heavy metals that was focused into conjugate fractures above and adjacent to the rising trondhjemite magma. The hot brines debouch onto the seafloor, mixed with unmodified seawater, triggering sulphide deposition.

3) Coeval clastic sedimentation near discharge orifices coupled with reworking and down-slope slumping of sulphide bearing muds produced mixed clastic and chemical sedimentary rocks.

4) The gold-bearing quartz carbonate veins within and marginal to the stock formed via circulation of a metamorphic fluid generated by burial metamorphism. Intense hydration and carbon dioxide fixation between the metamorphically derived fluids and the Gutcher Lake Stock and its aureole resulted in the development of greenschist facies mineralogy in the wallrocks to the veins.

5) The distribution of the gold-bearing veins to the Gutcher Lake Stock may be due to the relatively anhydrous mineralogy of the stock and its aureole which are susceptible to hydration and carbon dioxide fixation.

6) Native gold precipitation is postulation to have been encouraged where metamorphic fluids remobilized and reacted with pre-existing sulphide-bearing clastic and chemical sedimentary rocks within the wall rock.

7) Barren quartz carbonate veins formed where the metamorphically derived fluids did not encounter pre-existing sulphides in the wall rocks.

In examining the conclusions and model by Studemeister (1982, 1985b, 1985c), one aspect warrants some additional comment. Studemeister (1982, 1985b, 1985c) proposes that bedded sulphide-bearing sedimentary rocks are an important if not an essential factor in gold deposition. On the north side of the Gutcher Lake Stock amygdaloidal pillowed intermediate to mafic metavolcanic rocks are dominant with only scattered thin, complexly folded and brecciated, lenses of cherty iron formation and intermediate to felsic metavolcanic breccia. These lenses of iron formation represent local accumulations of interflow chemical sediments. Metasedimentary rocks with preserved primary sedimentary structures are lacking. A polymictic breccia with rounded chert pebbles occurs at the former campsite of Ego Resources Limited. On the south shore of Mall Lake, however, the unit lacks well preserved sedimentary structures and does not contain unusual sulphide concentrations. The author interprets this unit to be a debris flow more closely related to volcanism than sedimentation.

The author examined the mineralization in the decline on the B and C veins east of Mall Lake. These coarse-grained sulphides occur along schistosity planes of sheared intermediate to mafic metavolcanic rocks. Examination of mineralization exposed in numerous trenches on the property indicates the mineralization is transgressive to lithologic trends and occurs in all rock types found on the property. On the basis of field observation, the mineralization is epigenetic. If originally syngenetic in deposition, it has been extensively remobilized. The crosscutting nature of gold bearing veins in relation to iron formation was previously noted by Thomson (1921).

In examining maps showing of the location of gold and sulphide occurrences around the Gutcher Lake Stock, the first impression one gets is that mineralization forms a ring about the complex (Figure 33) implying a very close spatial association between stock and mineralization.

The showings around the Gutcher Lake Stock can be divided into two main groups;

1) the copper-gold B, C, along the north side of the stock, and

2) W-8 zones and the gold-bearing Southwest showing, Farquhar and Porter-Premier quartz-carbonate veins on the south side. The west and east sides of the stock have no significant mineralized showings.

The north side of the stock is the locus of extensive shearing along the axis of Mall Lake. The south contact is also intensely sheared. The strongly sheared north and south contacts contrast with the much less sheared west and east sides of the stock. The present sitting of the mineralization appears to be determined by the sites of the dilatent zones or structural traps and not by the stratigraphy.

If the mineralization is structurally controlled, the implications are that the mineralization is not directly related to the stock or stratigraphy, but that the stock and its aureole represent rocks which offer favorable structural sites for mineralization.

Taal (1986) reported that the average Au content of the intermediate to mafic metavolcanic rocks in the Musquash Township area to be 3.6 ppb and found that five quartz-tourmaline samples from the same area contain 1400 ppb or more gold. He observed, however, that not all the tourmaline-bearing rocks carried anomalous gold. The area of tourmaline alteration contains anomalous Au and warrants more detailed prospecting.

The presence of anomalous gold in the quartz-tourmaline veins found in Musquash Township suggests that the area of tourmaline alteration warrants prospecting and that hydrothermal activity was indeed involved in generating the tourmaline-bearing rocks.

RECOMMENDATIONS TO PROSPECTORS

The early investigators of the Michipicoten area recommended that prospecting be concentrated around felsic intrusions particularly where they are brecciated and sheared (Thomson 1926; Collins and Quirke 1926; Gledhill 1927; Moore 1931; Bruce 1940). The association of gold and felsic intrusions may be fortuitous. The presence of gold in and marginal to these stocks may be a function of the contrasting rock competency which under conditions of shearing provide favorable host sites to gold mineralization. A direct genetic connection with the emplacement of the felsic magmas is not clearly established.

While greenschist mineral assemblages characterize most gold deposits in the Wawa area the most productive mine in the Michipicoten supracrustal rocks is the Renabie Mine which is situated in higher grade rocks at the eastern margin of the belt outside the map area. A number of gold-bearing veins and shear zones to the south, in Esquega Township, occur at the position where low greenschist facies rocks are transitional into upper greenschist and perhaps locally lower amphibolite facies rocks (Sage 1987a). Gold mineralization appears independent of metamorphic grade.

In examining the mineralized showings within this map area and adjacent areas, there are several universal observations. These observations are as follows:

1) The gold is shear zone or structurally hosted. In all cases, the gold mineralization is presently epigenetic in style to its host rocks.

2) Carbonatization and silicification are universal alteration styles. Sericite plus traces of biotite or potassium feldspar in response to potassium metasomatism may be present in some deposits.

3) Pyritization of the shear zones is common but not completely universal.

Prospecting for gold in the map area should emphasize structure and the presence of a favorable rock alteration package.

Base metal mineralization is not common in the map area, however, a number of geophysically indicated conductors warrants testing. Deformed and folded iron formation warrants testing for both base metal and gold mineralization at favourable structural sites but iron formation is not likely to contain significant syngenetic base metal or gold mineralization.

The discovery of additional iron formation for the production of iron appears unlikely.

The greatest potential for the area is gold.

The massive granitic rock of the Troupe Lake Stock may make a good building stone. It has a reddish brown colour on a polished surface.

REFERENCES

Ayres, L.D. 1972. Guide to Granitic rock nomenclature used in reports of the Ontario Division of Mines; Miscellaneous Paper 52, 14p.

— 1978. Metamorphism in the Superior Province of northwestern Ontario and its Relationship to Crustal Development; in. Metamorphism in the Canadian Shield, Geological Survey Canada, Paper 78-10, p.25-36.

Anonymous ?. Report of the Josephine Iron Mine in the Michipicoten District in the Province of Ontario and Dominion of Canada; 12p. (AFRO).

— 1909. Josephine Mine; dated May 19, 1909, 8p. (AFRO).

— 1910. Report on Magpie Property, prepared for Lake Superior Corporation. 12p. (AFRO).

— 1919. Annual Report Magpie Mine 1919; unpublished report prepared for Algoma Steel Corporation Limited 7p. (AFRO).

— 1921. Report on condition of Magpie Mine, March 1921; prepared for Algoma Steel Corporation Limited, 5p. (AFRO).

— 1929. Untitled report, 4p. (AFRO).

— 1937a. Memorandum regarding the possible tonnage of Hematite Iron Ore in the Josephine Iron Mine in the Michipicoten District in the Province of Ontario, in the Dominion of Canada, 7p. (AFRO).

— 1937b. Untitled report, 3p.

— 1974. Report on Goudreau Project 1974, Drilling program and Assessment of Michipicoten Volcanic Belt; prepared for Getty Mines Limited, 10p. with attachments (AFRO).

— 1981. Report on diamond drilling program 1981 Lake Kozak property for Golden Spoke Mines Limited. prepared by A.C.A. Howe International Limited for Golden Spoke Mines Limited, 17p. with appendix (AFRO).

Atkins, W.F. 1969. Preliminary Evaluation of Pyrite Production Rand No.2 Goudreau, Ontario; unpublished report prepared by David S. Robertson and Associates Limited for Superior Iron And Acid Limited, 7p. (AFRO).

Barrett, R.E. 1951. Interim Report of Preliminary investigation Reopening Josephine Mine, unpublished report prepared for Algoma Steel Corporation, 6p.

Bell, J.M. 1905. Iron Ranges of Michipicoten West; in Annual Report Ontario Bureau of Mines Volume 14 part 1, p.278-355.

Bolton, L.L. 1914. Re: Josephine Exploration; memorandum to Mr. Taylor, 2p. (AFRO).

Booth, J.R. 1952. Memo on the Magpie Mine, prepared for Algoma Steel Corporation Limited, 2p. (AFRO).

Boyd, D.G. 1903. Michipicoten Mining Division, Ontario Bureau of Mines, Volume 12, 1903, p.62-65.

— 1904. Michipicoten Mining Division, Ontario Bureau of Mines, Volume 13, 1904, part 1, p.46-49.

Brewster, N.E. 1979. Report on the Lake Kozak Claims of Golden Spoke Mines Limited; located in Abotossaway Township, Ontario (formerly township 28) prepared for Golden Spoke Mines Limited 1979, 14p. (AFRO).

Brown, E.L. and Morrison, W.F. 1942. Geology of the Josephine Mine; Canadian Mining Journal Volume 63, p.5-9.

Brown, E.L. 1943a. Untitled, prepared for Michipicoten Iron Mines Limited, 15p. (AFRO).

— 1943b. Supplementary report on the Josephine Mine, Michipicoten Iron Mines Limited; prepared for Michipicoten Iron Mines Limited, 11p. with attachments (AFRO).

— 1943c. Michipicoten Iron Mines Limited Josephine (A.C.R.) Ontario Development Report; prepared for Michipicoten Iron Mines, 11p. (AFRO).

— 1946. Unpublished letter to Mr. George MacLeod, General Manager, 2p. (AFRO).

Bruce, E.L. 1940. Geology of the Goudreau - Lochalsh Area; Ontario Department of Mines, Annual Report, v. 49, pt. 3, p.1-50.

Bryant, J.G., Colvine, A.C, and Reilly, G.A. 1972. Goudreau Project, Report on Field Activities; prepared for Getty Mines Limited, 19p. (AFRO).

Bryant, J.G. and White, M.V. 1974. 1973 Goudreau Project, Report of Field Activities; prepared for Getty Mines Limited, 101p. with appendix (AFRO).

Burke, D.K. 1938. Algold Mines Limited - Goudreau Area; prepared for Erie Canadian Mines Limited, 2p. (AFRO).

Burns, C.A. 1968. Report on the property of Ego Mines Limited, Algoma District Ontario; prepared for Ego Mines Limited, 4p. (AFRO).

— 1973. Report on the property of Ego Mines Limited, District of Algoma, prepared for Ego Mines Limited, 5p. (AFRO).

Burrows, A.G. 1921. Memorandum on part of the Goudreau Gold Area, The Canadian Mining Journal August 5, 1921 p.621-622.

— 1922. Notes on the Goudreau Gold Area; Ontario Department of Mines, Volume 30 part 4 p.39-42.

Burwash, E.M. 1935. The Michipicoten-Missinaibi Area; Ontario Department of Mines, Annual Report, Volume 44, part 8, p.1-26

Calvert, T. 1983. Petrography and Geochemistry of an Archean Volcanic Sequence of the Josephine Area, Wawa, Ontario; unpublished B.Sc. Thesis Brock University, St. Catherines, Ontario, 28p.

Campell, N. and Williams, R.M. 1961. Adonis Mines Limited Summary Report Kozak Lake Claims Township 28, Range 26, Sault Ste. Marie Mining Division Goudreau Gold Area District of Algoma, Ontario; prepared for Adonis Mines Limited, 4p. (AFRO).

Canadian Mining Journal 1956. p.78-87, in Algoma Ore Properties Limited, Part 2. Helen Mine Geology, Canadian Mining Journal, Volume 77, p.5-130.

Carlisle, D. 1963. Pillow Breccias and their Aquagene Tuffs, Quadra Island, British Columbia; Journal of Geology, Volume 71, p.48-71.

Collins, W.H. 1918. The ore deposits of Goudreau and Magpie - Hawk areas in Michipicoten District, Ontario; Geological Survey of Canada, Summary Report, 1918, part E, p.4E-30E.

Collins, W.H. and Quirke, T.T. 1926. Michipicoten Iron Ranges, Geological Survey of Canada, Memoir 147, p.1-143.

Coleman, A.P. and Wilmott, A.B. 1902. The Michipicoten Iron Region; Report of the Ontario Bureau of Mines Volume 11, p.152-185.

Corkill, E.T. 1911. Mines in Ontario, Ontario Bureau of Mines Annual Report Volume 20, part 1 p.93-95.

— 1912. Mines of Ontario, Ontario Bureau of Mines Annual Report Volume 21, Part 1 p.112.

— 1913. Mines of Ontario, Ontario Bureau of Mines Annual Report Volume 22 Part 1, p.106-108.

Deer, W.A., Howie, R.A., Zussman, J. 1966. An introduction to the Rock - Forming Minerals; John Wiley and Sons Incorporated, New York, 528p.

Dolmage - Campbell and Associates Limited 1968. Preliminary Feasibility Study Rand Pyrite Property Goudreau, Ontario; prepared for Superior Iron and Acid Limited, 5p. with attachement (AFRO).

Drury, J.J. 1950a. The Alice Lake Magnetite Deposit; prepared for Jalore Mining Company Limited, 5p. (AFRO).

— 1950b. Subject Township 29, Range 25; untitled prepared for Jalore Mining Company Limited, 3p. (AFRO).

— 1951. Jalore Mining Company Limited Report of Geological Survey of West Brooks claims; prepared for Jalore Mining Company Limited, 8p. (AFRO).

— 1953. unpublished, untitled memorandum to Dr. W.M. Fiedler, Chief Geologist, Jones and Laughlin Steel Corporation, Pittsburg Pennsylvania, 2p. (AFRO).

Emmons, W.H. and Grou, F.F. 1935. Granitic stocks and related auriferous veins near Goudreau, Ontario; Bulletin Geological Society of America, v.46, p.1457-1466.

Esson, D.W. 1968. Preliminary Report on Rand Pyrite Property of Superior Acid and Iron Limited; prepared for Superior Acid and Iron Limited, 4p. (AFRO).

--- 1969. Progress report for Superior Acid and Iron Limited, Goudreau, Ontario; prepared for Superior Acid and Iron Limited, 33p. with attachments (AFRO).

--- 1970. Progress Report for Superior Acid and Iron Limited; prepared for Superior Iron and Acid Limited, 10p. with attachments (AFRO).

Flaherty, G.F. 1940. Memorandum Re. Amherst Gold Mines Limited Option; prepared for Norgold Mines Limited, 5p. (AFRO).

Fraser, D.C. 1973. Helicopter Geophysical Survey Hawk Junction Project Ontario Getty Mines Limited; prepared for Getty Mines Limited, (AFRO).

Frey, E.D. 1986. XII INQUA Congress - Ottawa 1987, North Shore of Lake Superior field trip; prepared for XII INQUA Meeting 1987, 8p.

--- 1987. Day 2, Wawa area, p.14-18 *in* Quaternary features and scenery along the North Shore of Lake Superior; XIIth INQUA Congress Field Excursion C-12.

Gallie, A.E. 1947a. Mining Methods and Costs at the Josephine Mine; The Canadian Institute of Mining and Metallurgy Volume L, p.589-636.

--- 1947b. Iron Ore Beneficiation at Josephine Mine; Canadian Institute of Mining and Metallurgy Volume 50, p.637-656.

Giguere, J. 1969. Untitled memorandum prepared for the Ontario Department of Mines on the Brooks Iron Ranges (AFRO).

Gillan, J.F. 1979. Report on Geological Survey Algoma Project 989 Wawa, Ontario; prepared for Amax Minerals Exploration, 50p. with attachements.

Gledhill, T.L. 1927. Michipicoten Gold Area, District of Algoma, Ontario Department of Mines 36th Annual Report, part 2, p.1-49.

--- 1934. Report on Soocana Mining Company Limited Mine Properties; prepared for Soocana Mining Company Limited to accompany prospectus, 4p. (AFRO).

Goetz, A. 1912. The Eastern Michipicoten Iron Range; Engineering and Mining Journal, Volume 93, Number 22, p.1090-1092.

--- 1921. Report on the Josephine Iron Mine; 8p. (AFRO).

--- 1922. Report on the Josephine Iron Mine; 1922, 8p. (AFRO).

--- 1931. Report on the Josephine Iron Mine, Location and extent; 4p. (AFRO).

Goldsmith, L.B. 1966. Algoma Ore Properties Division, Algoma Steel Corporation, Limited, Exploration Department, Josephine Extension Property, prepared for Algoma Steel Corporation Limited, 4p. (AFRO).

Goodwin, E.L 1912a. Summary Report of Prospecting in Township 28, Range 25, Algoma; prepared for Lake Superior Corporation, 4p (AFRO).

— 1912b. Report on Bartlett Siderite Deposit; prepared for Algoma Steel Corporation, 6p. (AFRO).

Goodwin, A.M. 1953a. Geological Map Township 29, Range 26 Magpie Area, District of Algoma, geology map prepared for the Algoma Central Railroad, (AFRO).

— 1953b. Geology of Magpie Township and Vicinity, Michipicoten Area; prepared for Algoma Steel Corporation Limited, 31p. (AFRO).

— 1955. Mall Lake copper prospect; prepared for Algoma Steel Corporation Limited, 4p. (AFRO).

— 1958a. Mall Lake Copper Prospect; for Algoma Steel Corporation Limited, 4p. (AFRO).

— 1958b. Barlett Iron Formation, prepared for Algoma Steel Corporation, 1p. (AFRO).

Goodwin, A.M. and Metcalf, H.S.K. 1953. Geological Map Township 28, Range 26, Magpie-Goudreau Area, District of Algoma; geological map prepared by Algoma Steel Corporation Limited (AFRO).

Goodwin, A.M. and Shklanka, R. 1967. Archean Volcano - Tectonic basins. Form and Pattern; Canadian Journal of Earth Science, v.4, p.777-795.

Graham, J.C.L. 1950. The east and central Brooks Iron Ranges, prepared for Jalore Mining Company Limited, 13p. (AFRO, Toronto).

Halstead, M.C. 1959a. Report on the Mining Property Held by Golden Algoma Mines Limited on the Algoma Central and Hudson Bay Mining Lands in the District of Algoma, Ontario, Canada; prepared for Golden Algoma Mines Limited, 4p. (AFRO).

— 1959b. Report on the Mining Property held by Peter Rock Mining Company Limited in Township 28, Range 25 on the Algoma. Central and Hadson Bay Railway Mining Lands, District of Algoma, Ontario, Canada; prepared for Peter Rock Mining Company Limited, 5p. (AFRO).

— 1960a. Report on the Farquhar Mining claims held by Golden Algoma Mines Limited in Township 28, Range 26 and Township 27, Range 26, District of Algoma, Ontario, Canada; prepared for Golden Algoma Mines Limited, 1960, 6p. (AFRO, Toronto).

— 1960b. Report on the Mining Property held by Golden Algoma Mines Limited Located in Township 28, Range 26, in the District of Algoma, Ontario, Canada; in Golden Algoma Mines Limited prospectus, p.9-13 (AFRO).

Hardman, J.E. 1910. Some of the Mining Properties of the Lake Superior Corporation, prepared for Lake Superior Corporation, 12p. (AFRO).

Harron, G.A. 1974. Canadian Pyrites Limited, Holdsworth property, Hawk Junction, Ontario; internal memorandum Dupont of Canada Exploration Limited, 2p. with attachment (AFRO).

Hasselbring, A. 1911. Report on Bartlett Property Township 28 Range 25, District of Algoma, prepared for Algoma Steel Corporation, 4p. (AFRO).

— 1912a. Bartlett Property Township 28, Range 25, Algoma, Annual Report for 1912; prepared for Algoma Steel Corporation 5p. (AFRO).

— 1912b. Annual Report on Prospecting, Michipicoten District; prepared for Lake Superior Corporation, 3p. (AFRO).

— 1914. Josephine; unpublished memorandum to Mr. J.F. Taylor, president (Lake Superior Corporation?), 2p. (AFRO).

— 1916. Magpie Tonnage; letter to Mr. J. Frater Taylor, President Algoma Steel Corporation Limited, 5p. (AFRO).

— 1917. Mining Methods at the Magpie Iron Mine; Transactions of the Canadian Mining Institute 1917, Volume 20 p.321-332.

Hawley, J.E. 1941. Memo on Geology of the Rand No.2 Pyrite-Siderite Deposit, Township 28, Range 26, Goudreau, Ontario; 6p. (AFRO).

— 1942a. Origin of Some Siderite, Pyrite, Chert deposits, Michipicoten District, Ontario; Transactions Royal Society Canada, Section 4, p.79-80.

— 1942b. Report on Rand No. 2 Pyrite Property Goudreau Ontario; prepared for Aldermac Copper Corporation Limited, 28p. (AFRO).

Hemstock, J.M. and Coyne, K.R. 1969. Preliminary Evaluation of Sulphuric Acid and Iron Oxide Pellet Production from a Pyrite Deposit at Goudreau,Ontario, prepared by A.H. Ross and Associates for Duncan R. Derry Limited, 21p. with attachments (AFRO).

Hesse, W.A. 1958. Report on the "Edwards" gold property Township 28, Range 25 (EF), District of Algoma, Ontario; prepared for Peter Rock Mining Company Limited, 3p. with attachments (AFRO).

Higgins, M.D. 1986. Nodule-bearing spessurtite (lamprophyre) dikes near Wawa, Northern Ontario *in* Program with Abstracts GAL, MAC, CGU-AGC, AMC, UCC joint meeting, Ottawa 1986, p.81.

Holliday, B.M. (?) Holliday - Bingham Claims, 3p. (AFRO).

Hopkins, P.E. 1928. Report on Kozak Mines Limited Mining Claims A.C. 1955-1959 and 1963-4-5, Township 28, Range 26, Goudreau, Ontario; (AFRO).

Hoshkiw, M.E. 1960. Geological Report Kozak claims, prepared for Adonis Mines Limited, 7p. (AFRO).

Hurst, M.E. 1928. Certain Lead-zinc Deposits in the District of Algoma, Ontario Department of Mines Annual Report volume 37, part 3, p.68-78.

Huxhold, P. 1974. Report for Laurasia Resources Limited on the Trench Sampling Program Lake Kozak Property Township 28, Range 26, Ontario; prepared for Laurasia Resources Limited, 12p. with appendix (AFRO).

Irvine, T.N. and Baragar, W.R.A. 1971. A guide to the Chemical Classification of the Common Volcanic Rocks; Canadian Journal of Earth Sciences, Volume 8, p.523-548.

Jeckell, A.W. 1967. Pyrite sulphide deposits Township 28, Range 25, Michipicoten Area, District of Algoma, Ontario; prepared to accompany prospectus for Jogran Mines Limited, p.15-18, (AFRO).

Jaeger, J.C. 1968. Cooling and Soldification of Igneous Rocks, p.483-502 *in* Basalts, Interscience Publishers, 862p.

Jensen, L.S. 1976. A New Cation Plot for Classifying Subalkalic Volcanic Rocks; Ontario Division of Mines, Miscellaneous Paper 66, 22p.

Jones, J.G. 1969. Pillow lavas as depth indicators; American Journal of Science, Volume 267, p.181-195.

Keeler, G.T. 1940. Geology of the Algold Mine, Goudreau, Ontario; unpublished M.Sc. thesis, University of Toronto, 36p.

Kemp R. 1981. Farquhar option Geology and Drill Report Goudreau, Ontario, NTS 42-C-2; prepared for Rio Tinto Canadian Exploration Limited, 14p. with appendix (AFRO).

Khan, M.A. 1973. Memorandum Evans Creek Magnetite; prepared for Algoma Steel Corporation Limited, 2p. (AFRO).

Kidd, R. 1974. Report on Property of Ego Mines Limited, Goudreau Area, District of Algoma, Ontario; prepared for Ego Mines Limited (AFRO).

Leggett, R.F. and Eden, W.J. 1960. Soil Problems in Mining on the Precambrian Shield; The Engineering Journal November 1960, p.81-87.

Leith, C.K. 1916a. Unpublished letter to Mr. J. Frater Taylor, President, Algoma Steel Corporation Limited, 3p. (AFRO).

— 1916b. Magpie Mine, prepared for the Algoma Steel Corporation Limited, 13p. (AFRO).

Lindeman, E. and Bolton, L.L. 1977. Iron Ore Occurrences in Canada; Mines Branch Department of Mines Ottawa, No. 217, p.37-39.

Lockwood, M.B. 1986. The petrogenetic and Economic significance of chloritoid in the Wawa Greenstone Belt; unpublished M.Sc. thesis, Carleton University, Ottawa, 220p.

— 1983. The Nature and Significance of Chloritoid in Footwall Basalt of the Josephine Iron Formation of the Michipicoten Area, Algoma District, Ontario; unpublished B.Sc., University of Western Ontario, London, Ontario; 75p.

Lisowyk, A.J. 1987. Alteration in the footwall of the Magpie Iron Formation, Wawa, Ontario; unpublished B.Sc. thesis, University of Western Ontario, London, Ontario, 56p.

Macauley, T.M. 1962. Geological Report on Wagner's anomaly 1a - Magpie Area (Township 29, Range 25 (EE); prepared for Algoma Steel Corporation Limited, 3p. (AFRO).

MacDonald, B.I. 1964a. Geological Survey Township 28, Range 25, Hollinger Consolidated Gold Mines Limited; prepared for Hollinger Consolidated Gold Mines Limited, 7p. (AFRO).

— 1964b. Geomagnetic Survey Township 28, Range 25 Hollinger Consolidated Gold Mines, Limited; prepared for Hollinger Consolidated Gold Mines Limited, 4 p. (AFRO).

— 1964c. Geomagnetic Survey Township 28, Range 25 Hollinger Consolidated Gold Mines Limited, prepared for Hollinger Consolidated Gold Mines Limited, 4p. (AFRO).

MacLeod, C.W. and Cowie, G.S. 1926. The Goudreau Gold Area, Canadian Institute Mining and Metallurgy Bulletin Number 167, March 1926, p.393-401.

MacLeod, G.W. 1923a. The Goudreau Gold Area; The Canadian Mining Journal, April 20, 1923, p.295-297.

— 1923b. Unpublished letter to Mr. G.A. Montegomery Vice President and General Manager of Algoma Central and Hudson Bay Railroad Company, 3p. (AFRO).

— 1923c. Unpublished letter to Mr. G.A. Montgomery Vice President and General Manager of Algoma Central and Hudson Bay Railroad Company, 2p. (AFRO).

— 1923d. Unpublished letter to Mr. G.A. Montgomery Vice President and General Manager of Algoma Central and Hudson Bay Railroad Company, 1923 4p. (AFRO).

— 1925. Goudreau Gold Mines Limited, unpublished report prepared for Mr. G.A. Montgomery Vice President and General Manager of Algoma Central and Hudson Bay Railroad Company, 8p. (AFRO).

— 1927. Untitled description prepared for a Mr. N.W. Miller (AFRO).

— 1931. Report on the Josephine Iron Mine; unpublished report prepared for the Algoma Steel Corporation, 5p. (AFRO).

— 1943. Untitled report prepared for Algoma Steel Corporation; dated May 22, 1943, 3p. (AFRO). 1946. Unpublished letter to Sir James Dunn Bart, President, Algoma Steel Corporation Limited; 3p. (AFRO).

MacLeod, I.N. 1979. Results of a Combined Magnetic and Electromagnetic Survey Hawk Junction Area, Northern Ontario; prepared for Noranda Exploration Company Limited, 13p. with attachments (AFRO).

Massey, N.W.O. and Jeanings E. 1983. Precambrian Geology of Lendrum Township and Parts of Gros Gap IR 49 Algoma District; Ontario Geological Survey, Map P 2681, Geological Series, Preliminary Map, Scale 1.15:840.

Massey, N.W.O. 1985. Geology of the Mishewawa Lake area, District of Algoma, Ontario Geological Survey, Open File Report 5532, 167p.

McAuslan, D.A. 1974. Hawk Junction Pyrite Prospect (Holdsworth Property), internal memorandum Dupont of Canada Exploration Limited, 2p. (AFRO).

McGinn, G.J. 1982. A Summary Report on the Ego Mines Property District of Algoma, Ontario, prepared for Ego Mines Limited (AFRO).

McKay, B.J. 1984. Diamond Drill Report Algoma Project Corbiere Township 036-12; prepared for Canamax Resources Limited, 4p. with attachments (AFRO).

McKee, J.P. 1950. Report on the Brooks Ranges, T 28-R25 District of Algoma, Ontario; prepared for Jalore Mining Company Limited, 7p. (AFRO).

McKee, J.P.Melville, W. 1911. Annual Report of Magpie Mine for 1911 Township 29, Range 26, District of Algoma; prepared for the Lake Superior Corporation, 20p. (AFRO).

Middleton, B.M. and Thompson, I.S. 1969. Superior Acid and Iron Limited Preliminary evaluation of Rand Pyrite Property, Goudreau, Ontario; prepared by Duncan R, Derry Limited for Superior Acid and Iron Limited, 52p. (AFRO).

Moore, E.S. 1931. Goudreau and Michipicoten Gold Areas, District of Algoma, Ontario Department of Mines, Annual Report, Volume 40, part 4, p.1-54.

— 1948. Structure of the Michipicoten - Goudreau area, in structure of Canadian Ore Deposits, Geology Division Canadian Institute of Mining and Metallurgy, p.414-419.

Moore, E.S. and Armstrong, H.S. 1946. Iron Deposits in the District of Algoma; Ontario Department of Mines, Annual Report, Volume 55, part 4, p.1-118.

Moore, J.G. 1965. Petrology of Deep-Sea Basalt Near Hawaii; American Journal of Science, Volume 263, p.40-52.

Morrison, W.F. 1948. Josephine Mine; p.429-432 *in* Structural Geology of Canadian Ore Deposits, Symposium arranged by a Committee of the Geology Division, Canadian Institute of Mining and Metallurgy.

Morrison, L.G. 1977a. Magnetometer Survey for United Canso Oil and Gas Limited, SSM - 359902 and SSM - 359905 claims of Ego Mines Limited Township 28 Range 26, District of Algoma, Ontario; prepared for United Cango Oil and Gas Limited, 2p. (AFRO).

— 1977b. Magnetometer Survey for United Canso Oil and Gas Limited, SSM 407890 (Ego Mines Claims) Abotossaway Township, District of Algoma, Ontario; prepared for United Canso Oil and Gas Limited, 2p. (AFRO).

— 1978. Geological report southwest claims (SSM - 359902 to SSM - 359911 and SSM - 407889) Ego Mines Limited Abotossaway Township Sault Ste. Marie Mining Division, Province of Ontario (for United Canso Oil and Gas Limited), 11p. (AFRO).

Neale, K.L. 1981. Sedimentology, Petrography, and Depositional environment of Dore sediments above the Helen - Eleanor Iron Range, Wawa, Ontario; unpublished B.Sc. Thesis, McMaster University, 54p.

Neelands, J.T. 1984. Geological Report on the Alice Lake property, LeClaire Township Sault Ste. Marie Mining Division for R.J. McGowan, Vancouver, British Columbia, 22p. with attachments (AFRO).

Neelands, J.T.; Turner, R.W.; and Deveaux, P.J. 1984a. Geoscientific Exploration Report Appendix 1 - Sheet 5, 6 on Operation Wawa Sault Ste. Marie Mining Division Ontario for International Corona Resources Limited, (AFRO).

— 1984b. Geoscientific Report Appendix I sheet 3, 4 on Operation Wawa Sault Ste. Marie Mining Division Ontario for International Corona Resources Limited, 1984 (AFRO).

ODM-GSC 1963a. Wawa, Ontario Department of Mines, Geological Survey, Canadian Map 2192 G, Scale 1:63 360.

— 1963b. Goudreau, Ontario Department of Mines, Geological Survey, Canada Map 2193 G, Scale 1:63 360.

Ontario Iron Ore Committee 1924. Magpie Mine, Report of the Ontario Iron Ore Committee with Appendix 1923, 306p.

Ojakangas, R.W. 1983. Clastic sedimentary rocks of the Michipicoten Volcanic - Sedimentary Belt, Wawa, Ontario, p.66-70 *in* Workshop on A cross section of Archean Crust; Lunar and Planetary Institute, Technical Report 83-03.

— 1985. Review of Archean clastic sedimentation Canadian Shield: Major felsic volcanic contributions to turbidite and alluvial fan-fluvial facies association; p.23-47.

Oudkerk, G. 1983. The Extent of Chloritoid Within the Rand No. 2 Pyritic Iron Formation; unpublished B.Sc. Thesis, University of Western Ontario, 39p.

Palmer, R.N. ? Magnetic Survey of Alice claims; 6p. (AFRO).

Parsons, A.L. 1915. The Productive Area of the Michipicoten Iron Ranges; Ontario Bureau of Mines Annual Report, Volume 24, Part 1, p.185-215.

Reid, R.G. and Sears, S.M. 1984a. Report on a Geophysical Survey over the properties of R.J. McGowan, Abotossaway Township, Sault Ste. Marie Mining Division, Ontario, prepared for R.J. McGowan, 37p.

— 1984b. Report on a geophysical survey over the Alice Lake property of R.J. McGowan LeClaire Township, Sault Ste. Marie Mining Division Ontario; prepared for R.J. McGowan, 26p. (AFRO).

Reilly, G.A. 1973. 1972 Summary Review Goudreau Project, prepared for Getty Mines Limited, 4p. (AFRO).

Richards, W. and Schmidt, R. 1947. Report of Reconnaissance September 9-12, 1947, (AFRO).

Richter, D.H. 1951. Geology of the West End of the Central Brooks Iron Range; prepared for Jalore Mining Company Limited, 5p. (AFRO).

— 1952. Mineralogy and Origin of the Michipicoten Iron Formation, unpublished M.Sc. Thesis Queens University, 97p.

Riddell, G.B. 1962. Golden Algoma Mines Limited; Ontario Department of Mines Annual Report Volume 70, p.29.

Ringsleben, W.C. and Burns, C.A. 1965. Report on the property of Ego Mines Limited. Goudreau Area, Ontario; prepared for Ego Mines Limited, 5p. (AFRO).

— 1966. Report on Ego Mines Limited, Goudreau Area, Ontario, prepared for Ego Mines Limited, 5p. (AFRO).

— 1967. Report on the property of Ego Mines Limited, prepared for Ego Mines Limited, 6p. (AFRO).

Robertson, C.P. 1959. A Report on Golden Algoma Mines Limited, prepared for Golden Algoma Mines Limited, 7p. (AFRO).

Sage, R.P. 1983. Josephine Area, District of Algoma; p.45-49, *in* Summary of Field Work, 1983, Ontario Geological Survey, Miscellaneous Paper 116, 313p.

— 1987a. Geology of Chabanel, Esquega, Lastheels, and McMurray Township, District of Algoma, Ontario Geological Survey, Open File Report 5586

— 1987c. Geology of Aguonie, Bird, Finan, and Jacobson Township, District of Algoma, Ontario Geological Survey, Open File Report 5588.

Seelye, R.W. 1909. Re: Josephine Mine Proposition; prepared for Mr. W.C. Franz. General Manager, 2p. (AFRO).

Sheridan, J.P. 1960. Report on Geophysical Surveys Adonis Mines Limited. Kozak Lake property, prepared for Adonis Mines Limited, (AFRO), 3p.

Sinclair, D.G. 1931. Bennett - Pacaud Mines Limited; p.67-68 *in* Mines in Ontario in 1930, Ontario Department of Mines, Annual Report, Volume 40, Part 1.

— 1935. Algold Mines Limited; p.67-68 *in* Mines in Ontario in 1934, Annual Report Ontario Department of Mines, Volume 44, Part 1.

— 1936. Algold Mines Limited; p.78 *in* Mines in Ontario in 1935, Ontario Department of Mines Annual Report; Volume 45, Part 1.

— 1937. Algold Mines Limited; p.93 *in* Mines in Ontario in 1936, Ontario Department of Mines, Annual Report, Volume 46, Part 1.

— 1938. Algold Mines Limited, p.84-85 *in* Mines in Ontario in 1937, Ontario Department of Mines, Annual Report, Volume 47, Part 1.

— 1939. Algold Mines Limited; p.74-75 *in* Mines in Ontario in 1938, Ontario Department of Mines, Annual report, Volume 48, Part 1.

Sirola, W. 1953. Big Lake Pyrite Deposits and Adjacent "Iron Formations", Michipicoten Area, District of Algoma, Ontario; prepared for Candela Development Company, 31p.(AFRO).

— 1954a. Reau-Mary Lakes Area, Township 28, Range 25 and 26, Michipicoten Area, Algoma District, Report on 1954 Exploration; prepared for Candela Development Company Limited, 7p. (AFRO).

— 1954b. Geophysical and Geological Reconnaissance, Township 28, Range 26, Michipicoten District, Ontario; prepared for Candela Development Company Limited, 7p. (AFRO).

— 1954c. Preliminary report on Pyrite and Siderite Occurrences at Reau Lake and Mary Lake, Michipicoten District, Ontario; prepared for Candela Development Company Limited, 5p. with attachments (AFRO).

Slack, J.F; Coad, P.R. 1986. Iron-Rich Tourmalines from Kidd Creek, Ontario; *in* Program with Abstracts, GAC, MAC, LGU-AGL, AMC, UCG Joint meeting, Carleton University, Ottawa, Ontario, p.128.

Smith, D.E. 1964. Summary Report on the Rand No.2, Pyrite-Siderite Property located in A.C.R. Township 28, Range 26, Goudreau Area, Ontario and owned by IRSUGO Consolidated Mines Limited; prepared for Algoma Steel Corporation Limited, 3p. (AFRO, Toronto).

Smith, P.A. and Drorak, Z. 1983. Dighem III Survey of the O'Reilly Option, Wawa Area, Ontario for Falconbridge Limited by Dighem Limited, 44p., plus attachments (AFRO).

Smith, P.E., Tatsumato, M. and Farquhar, R.M., 1987. Zircon Lu-Hf systematics and the evolution of the Archean crust in the southern Superior Province Canada; Contribution Minerology and Petrology, v.97, p.93-104.

Staff of the Mines Inspection Branch 1961. Golden Algoma Mines Limited; Ontario Department of Mines, Annual Report Volume 69, p.23-24.

Streckeisen, A. 1976. To Each Plutonic Rock its Proper Name, Earth Science Reviews, Volume 12, p.1-33.

Studemeister, P.A. 1982. An Archean Felsic Stock with Peripheral Gold and Copper Occurrences, Abotossaway Township, District of Algoma, Ontario, unpublished Ph.D. Thesis, University of Western Ontario, London, Ontario, 501p.

— 1983. The greenschist facies of an Archean assemblage near Wawa, Ontario, Canadian Journal of Earth Science, Volume 20, p.1409-1420.

— 1985a. The greenschist metamorphism of Archean synvolcanic stocks near Wawa, Ontario, Canada; Journal of Metamorphic Geology, Volume 3, p.79-90.

— 1985b. Gold-bearing veins around a felsic stock near Wawa, Ontario; implications for gold exploration; Canadian Mining and Metallurgical Bulletin, Volume 78, no.874, p.43-47.

— 1985c. A hypothesis for base and noble metal deposits; Geologische Rundschau, Volume 74/1, p.51-59.

Studemeister, P.A. and Colvine, A.C. 1978. Geology and Mineralization of the Gutcher Lake Stock; p.218-221 *in* Summary of Field Work 1978, Ontario Geological Survey, Miscellaneous Paper 82.

Studemeister, P.A., Kerrich, R., Fyfe, W.S. 1981. Grant 56 Part B Geochemistry and Field Relations of Lode Gold Deposits in Felsic Igneous Intrusions - The Gutcher Stock, p.267-291 *in* Geoscience Research Grant Program, Ontario Geological Survey, Miscellaneous Paper 98.

Sutherland, T.F. 1914. Magpie Mine; p.124-127 *in* Mines of Ontario, Ontario Bureau of Mines, Annual Report, Volume 23, Part 1.

— 1915. Magpie Mine; p.105-107 *in* Mines of Ontario, Ontario Bureau of Mines, Volume 24, Part 1.

— 1917. Helen Mine; p.75, *in* Mines in Ontario, Ontario Bureau of Mines, Annual Report, Volume 26, Part ?.

— 1918. Helen Mine; p.88 *in* Mines in Ontario, Ontario Bureau of Mines, Annual Report, Volume 27, Part 1.

— 1919. Helen, Magpie Mines; p.105 *in* Mines of Ontario, Ontario Bureau of Mines, Annual Report, Volume 28, Part 1.

— 1920. Magpie Mine; p.69-70 *in* Mines of Ontario, Ontario Department of Mines, Annual Report, Volume 24, Part 1.

— 1921. Magpie Mine; p.65 *in* Mines of Ontario, Ontario Department of Mines, Annual Report, Volume 30, Part 1.

— 1922. Magpie Mine; p.22 *in* Mines of Ontario; Ontario Department of Mines, Annual Report, Volume 31, 1922, part 10.

— 1923. Goudreau Area; p.21-31 *in* Ontario Department of Mines, Annual Report, Volume 32, Part 6.

— 1925. Goudreau Gold; p.22 *in* Ontario Department of Mines, Annual Report, Volume 33, Part 7.

— 1926. Goudreau Gold Mines Limited; p.102-103 *in* Mines of Ontario, Ontario Department of Mines, Annual Report, Volume 35, Part 1.

— 1927. Goudreau Gold Mines Company Limited, p.106 *in* Mines of Ontario, Ontario Department of Mines, Annual Report, Volume 36, Part 1.

Taylor, H.J. 1950. East Brooks Drilling Program; prepared for Jalore Mining Company Limited, 3p. (AFRO).

Thomas, D.A. 1984. Stratigraphy, Lithology, Petrology, and depositional environments of the Dore Sediments proximal to the Lucy Iron range, Wawa, Ontario; unpublished B.Sc. Thesis, Carleton University, 37p.

Thomson, E. 1921. Goudreau Gold Area, Michipicoten District, Ontario; Geological Report 1921, part D, p.17D-26D.

— 1926. Part II, Missinaibi Map Area; in Michipicoten Iron Ranges, Geological Survey of Canada, Memoir 147, p.143-175.

Tower, W.O., Smith. R.L., Bawden, W.E., Cooper, D.F., Taylor, J.B., Walkom, L.K., Little, E.S., Weir, E.B., Douglass, D.P., Ward, J.L. 1948. Michipicoten Iron Mines Limited; p.84-86 *in* Mines of Ontario in 1945, Ontario Department of Mines, Annual Report, Volume 55, Part 2.

Tower Smith. R.L., Bawden, W.E., Cooper, D.F., Taylor, J.B., Walkom, L.K., Little, E.S., Weir, E.B., Douglass, D.P., Ward, J.L. 1949. Michipicoten Iron Mines Limited; p.96-97 *in* Mines of Ontario in 1946, in Ontario Department of Mines, Annual Report, Volume 56, Part 2.

Turek, A., Smith, P.E. and Van Schmus, W.R. 1982. Rb-Sr and U-Pb Ages of Volcanism and Granite Emplacement in the Michipicoten Belt - Wawa, Ontario; Canadian Journal of Earth Science, Volume 19, p.1608-1626.

— 1984. U-Pb Zircon ages and the evolution of the Michipicoten plutonic - volcanic terrane of the Superior Province, Ontario; Canadian Journal of Earth Sciences, v. 21, p.457-464.

Vallance, R.F. 1961. Notes on Ego Mines Limited, Goudreau, Ontario, prepared for Ego Mines Limited, 7p., (AFRO).

— 1964a. Report on Ego Mines Limited, Goudreau, Ontario; report for Ego Mines Limited, 5p. (AFRO).

— 1964b. Report on Mapping of a part of Ego Property Township 28, Range 26, Sault Ste. Marie Mining Division, November 1964; prepared for Ego Mines Limited, 3p. (AFRO).

— 1965a. Report on Ego Mines Limited, April 1965; prepared for Ego Mines Limited, 6p. with appendix (AFRO).

— 1965b. Ego Mines Limited Goudreau, Ontario, Report on Explorations, May - September 1965; prepared for Ego Mines Limited, 7p. (AFRO).

— 1971. Report on Ego Mines Limited, Township 28, Range 26, District of Algoma, Ontario, prepared for Ego Mines Limited, 16p. with attachments (AFRO).

Vishnupada, B. 1962. Godon Lake Iron Formation, Township 29, Range 26, Michipicoten; prepared for the Algoma Steel Corporated, 3p. (AFRO).

Wagner, E.P. 1962. Geophysical Report on Anomaly No. 1a, Township 29, R. 25; prepared for the Algoma Steel Corporation, 2p. (AFRO).

Wakeford, J. and Waddell, L. 198[illegible] Geological and Geophysical report on Algoma Central Railway Option, Wawa, Ontario; prepared for Noranda Exploration Company Limited, 22p. with attachments (AFRO).

Walker, A.J. 1983. Falconbridge Limited O'Reilly Option Esquega and Corbiere Townships, Ontario, Report on Magnetic and VLF-EM Surveys; prepared for Falconbridge Limited, 6p. (AFRO).

Ward, J.T. 1984a. VLF-EM, Magnetic and Geological Surveys, Abotossaway Township, Ontario for Bonzano Exploration Limited; prepared for Bonzano Exploration Limited, 3p. (AFRO).

— 1984b. Humus Geochemistry, Abotossaway Township, Ontario for Bonzano Exploration Limited, prepared for Bonzano Exploration Limited, 3p. (AFRO).

Watts, A. 1980. Report on Detailed Ground Geophysical Surveys, Amax Project 989, ACR Property, Wawa, Ontario, prepared for Amax Minerals Exploration, 22p. (AFRO).

Webber, G.R. 1950a. Central Brooks 1950, prepared for Jalore Mining Company Limited, 3p. (AFRO).

— 1950b. East Brooks 1950, prepared for Jalore Mining Company Limited, 4p. (AFRO).

— 1950c. West Brooks 1950; prepared for the Jalore Mining Company Limited, 4p. (AFRO).

Wendeborn, E.J. 1951. Report on the Diamond Drilling of the Josephine Siderite deposit, Josephine Property, Michipicoten Iron Mines Limited, Josephine, Ontario; prepared for Michipicoten Iron Mines, 4p. (AFRO).

White, A.M. 1978. Geological report SSM 407890, Ego Mines Limited. Abotossaway Township Sault Ste Marie Mining Division Ontario, prepared for United Canso Oil and Gas Limited, 3p. (AFRO).

Williams, R.M. 1960. Adonis Mines Limited Summary Report Kozak Lake claims Township 28, Range 26, Sault Ste. Marie Mining Division Goudreau Gold Area, District of Algoma, Ontario; prepared for Adonis Mines Limited, 8p. (AFRO).

— 1967. Summary Report Lake Kozak Mines Limited Kozak Lake claims, Township 28, Range 26, District of Algoma, prepared for Lake Kozak Mines Limited, 9p. (AFRO).

— 1968. Summary Report Lake Kozak Mines Limited Kozak Lake claims, Township 28, Range 26, District of Algoma, Ontario; prepared for Lake Kozak Mines Limited, 13p. with attachments (AFRO).

Willmott, A.B. 1904. Josephine, prepared for the Lake Superior Corporation, 5p. (AFRO).

Winkler, H.G. 1967. Petrogenesis of Metamorphic Rocks, Springer-Verlag, New York Inc. 237p.

Woodard, J.A. 1977. Electromagnetic Survey for United Canso Oil and Gas Limited on the Main Grid, Ego Mines Property Abotossaway Township, District of Algoma, Ontario; prepared for United Canso Oil and Gas Limited, 4p., (AFRO).

Worona, R.M. 1982. The Chloritoid Alteration at the Josephine Mine, District of Algoma; unpublished B.Sc. Thesis, University of Waterloo, Waterloo, Ontario; 56p.

Wright, J.F. 1939. Report on the gold deposit of Amherst Gold Mines Limited, Goudreau Area, Ontario, prepared for Amherst Gold Mines Limted, 6p. (AFRO).

Young, W.L. 1951. Report on the Sheldon Lake, Newric, Big Lake, and Cline Lake Iron Formations; prepared for Jalore Mining Company Limited, 9p. (AFRO).

— 1953. The Iron Bearing Formations of the Michipicoten Area, Ontario, unpublished Ph.D. Thesis, McGill University, Montreal, Quebec, 132p.

Yule, G. 1982. Proposed Exploration Program Algoma Central Railway - Amax option, Algoma Project Group 036 Corbiere Township - Algoma District; prepared for Amax Minerals Exploration, 6p. (AFRO).

— 1983a. Algoma Project - Corbiere Township, Summary of Work 1982, project 036 11 and 12, NTS C/2; prepared for Canamax Resources Incorporated, 14p. (AFRO).

— 1983b. Summary work 1983, Algoma Project - Corbiere Township, Project 036 -11/12 NTS 42 C/2; prepared for Canamax Resources Incorporated, 7p. with attachments (AFRO).

Zodrow, E.L. 1963. Summary Report on (Britannia) Bartlett Property; prepared for Algoma Steel Corporation, 9p. (AFRO).

Zurowski, M. 1959. Report on Geophysical Surveys on the property of Realm Mining Corporation Limited; prepared by Simard, Knight and Associates for Realm Mining Corporated Limited, 3p. (AFRO).

Table 2: Table of lithologic units for Abotossaway, Corbiere, Leclaire, and Musquash Townships, District of Algoma, modified after Sage (1987a).

- PHANEROZOIC
  - Cenozoic
    - Pleistocene and Recent
      - Till, sand, gravel, clay, organic soils
        - Unconformity

- PRECAMBRIAN
  - Proterozoic
    - Diabase dike
      - Intrusive Contact
  - Archean
    - Trondhjemite, granodiorite, quartz monzonite
      - Intrusive & Fault Contact
    - Mafic to intermediate Volcanics
      - Conformable Contact
    - Gutcher Lake Stock
      - Intrusive Contact
    - Diorite, gabbro, & quartz diorite intrusives
      - Intrusive Contact
    - Intermediate to Felsic Volcanics & associated metasediments
      - Conformable Contact
    - Tholeiite & high Irion Tholeiite Volcanics
      - Conformable Contact
      - Intrusive Contact
    - Iron formation
      - Conformable Contact
    - Jubilee Stock
    - Quartz - feldspar Porphyry
      - Intrusive Contact
    - Intermediate to Felsic Volcanics (Wawa tuffs)
      - Conformable Contact
    - Jubilee tuffs, minor iron formation
      - Conformable Contact
    - Tholeiite & High Iron Tholeiite Volcanics
      - Conformable Contact
    - Iron formation
      - Conformable Contact
    - Hawk Lake Granite Complex
      - Intrusive Contact
    - Intermediate to felsic Volcanics
      - Conformable Contact
    - Diorite, gabbro, peridotite(?)
      - Intrusive Contact
    - High Iron Tholeiites & Basaltic Komatiites Volcanics

Table 1: Geologic mapping assistants for Abotossaway, Corbiere, Leclaire and Musquash Townships.

Mapping of portions of these four townships began in 1981 and continued until 1981 at which time they had been completely mapped. Table 1 lists the individuals who assisted in the mapping of the area and their respective position.

Name	**Year**	**Role**
D. England	1981	Senior
T. Calvert	1981	Senior
J. Inasi	1981	Senior
K. Kosciusko	1981	Junior
G. Ondkerk	1981	Junior
R. Worona	1981	Junior
T. Calvert	1982	Senior
R. Epstein	1982	Senior
M. Lockwood	1982	Junior
R. Reid	1982	Junior
D. Thomas	1982	Junior
M. Lockwood	1983	Senior
D. Meyer	1983	Junior
D. Thomas	1983	Junior
D. Thomas	1984	Senior
R. Borthwick	1984	Junior
A. Lisowyk	1984	Junior
G. MacMaster	1984	Junior
G. MacMaster	1985	Senior
R. Borthwick	1985	Junior
V. Coleman	1985	Junior
A. Lisowyk	1985	Junior

Table 3 : Whole rock chemical analysis of intermediate to mafic metavolcanic rocks, Musquash Township (from T
1986) (Analysis by Geological Survey of Canada using Inductively Coupled Plasma (ICP) Techniques).

		MASSIVE FLOWS							PILLOWED FLOWS				
SAMPLE No:		TM104	TM049B	TM021W	TM082	TM116	TM001B	TM118SE	TM048W	TM052A	TM099	TM085	TM097A
SiO2	%:	49.50	46.00	44.40	43.60	37.20	51.70	50.80	48.00	46.40	42.70	41.50	39.40
TiO2	%:	0.87	1.20	0.57	0.48	1.21	0.83	1.12	1.07	0.86	1.23	0.71	1.00
Al2O3	%:	15.30	14.50	15.80	11.40	16.60	14.90	14.80	12.50	12.40	13.70	11.20	10.90
Fe2O3t	%:	12.60	14.60	12.60	10.60	16.00	9.48	10.90	11.50	14.00	14.50	10.20	11.70
Fe2O3	%:	4.00	3.40	1.30	1.20	2.90	3.20	2.00	3.20	2.00	2.80	1.40	1.40
FeO	%:	7.70	10.10	10.20	8.50	11.80	5.70	8.00	7.50	10.80	10.50	7.90	9.30
MnO	%:	0.21	0.21	0.18	0.19	0.24	0.17	0.26	0.26	0.20	0.31	0.33	0.36
MgO	%:	7.73	8.18	10.10	10.80	8.14	4.20	4.34	4.07	4.81	4.10	3.72	3.57
CaO	%:	10.70	11.10	5.72	9.90	6.79	11.90	6.93	14.30	9.28	10.40	16.10	15.40
Na2O	%:	1.32	1.46	2.32	0.41	1.11	2.32	3.08	2.47	2.02	2.16	2.36	1.7
K2O	%:	0.02	0.03	0.00	0.00	0.29	0.01	0.02	0.02	0.01	0.03	0.01	0.0
H2Ot	%:	3.50	3.80	5.70	5.60	4.30	2.20	3.30	2.20	4.20	4.90	3.00	3.1
CO2t	%:	0.20	0.60	4.20	7.40	9.80	1.50	2.90	5.10	6.50	5.90	12.20	11.6
P2O5	%:	0.07	0.10	0.05	0.05	0.09	0.07	0.09	0.10	0.08	0.11	0.05	0.1
S	%:	0.00	0.01	0.00	0.01	0.00	0.09	0.00	0.00	0.20	0.88	0.15	0.0

Minor elements by emission spectrography (Analysis by Geological Survey of Canada)

		TM104	TM049B	TM021W	TM082	TM116	TM001B	TM118SE	TM048W	TM052A	TM099	TM085	TM097A
Ce	PPM:	25	27	21	19	75	24	22	25	22	20	20	24
Ba	PPM:	0.6	0.8	0.4	0.5	0.7	0.6	0.7	0.8	0.5	0.7	0.6	0.
Co	PPM:	53	63	50	54	58	50	56	45	57	71	43	46
Cr	PPM:	260	140	200	200	250	250	210	110	100	120	96	110
Cu	PPM:	120	130	75	92	25	140	100	110	170	130	96	120
La	PPM:	14	19	11	11	16	15	18	18	14	19	13	18
Ni	PPM:	160	180	170	300	150	150	130	94	100	100	100	91
Y	PMM:	280	330	200	190	350	290	330	300	280	320	220	280
Yb	PPM:	1.9	2.3	1.4	1.5	2.3	1.8	2.2	2.2	2.1	2.6	1.8	1.
Zn	PPM:	89	110	85	79	140	89	110	100	110	120	95	82
Totals:	:	101.1	100.7	100.5	99.5	100.5	98.8	97.6	100.8	99.8	99.7	100.5	97.
Density	:	3.03	3.02	2.76	2.75	2.93	2.93	2.83	2.95	2.79	2.84	2.77	2.

Minor elements by X-ray Fluorescence Analysis (Analysis by Geological Survey of Canada)

		TM104	TM049B	TM021W	TM082	TM116	TM001B	TM118SE	TM048W	TM052A	TM099	TM085	TM097A
As	PPM:	0	15	2	0	48	39	5	8	6	20	0	10
Br	PPM:	0	4	0	2	0	0	4	1	0	4	0	6
Mo	PPM:	0	1	1	0	0	0	1	2	0	0	0	2
Nb	PPM:	0	4	1	1	0	1	3	2	1	4	0	4
Pb	PPM:	0	7	0	3	6	3	2	6	4	9	0	7
Rb	PPM:	0	1	2	1	10	1	0	2	1	2	0	1
Sr	PPM:	150	170	39	68	73	140	99	110	68	140	85	140
Th	PPM:	0	5	4	4	4	0	1	3	3	2	0	0
U	PPM:	0	4	1	3	3	0	5	1	0	3	0	[illegible]
Y	PPM:	17	24	12	28	25	22	31	26	21	29	16	2
Zr	PPM:	46	76	34	34	71	49	71	70	50	78	41	6

T = Total water content; total carbon content expressed as CO2, and total iron expressed as Fe2O3, total ir
converting FeO to Fe2O3 and adding this to the measured Fe2O3. The above totals use FeO + Fe2O3.
1 = Location of samples given on compilation map for Musquash Township.

Table 4 : Microprobe Analyses of Tourmaline and Chlorite from Musquash Township (from Taal 1986) (see Compilation Map for sample locations) within Tourmaline-bearing intermediate mafic metavolcanics)

Microprobe Data on Tourmaline Samples

Samples: TM 116, TM 48W, TM 104, TM 115V, TM 97.

TM 116

	C1Rim	C1Core	C2Rim	C2Core	C3	C4Rim	C4Core
SiO2	35.43	35.09	35.10	35.36	35.55	35.32	35.33
TiO2	0.21	0.59	0.27	0.32	0.19	0.51	0.39
Al2O3	31.47	31.31	31.47	31.14	31.67	30.95	30.79
FeO	8.94	9.51	9.35	8.61	8.16	8.94	9.27
MnO	0.05	0.07	0.05	0.03	0.03	0.02	0.04
MgO	6.54	6.60	6.41	6.55	6.49	6.58	6.64
CaO	0.59	0.53	0.46	0.44	0.42	0.50	0.58
Na2O	2.56	2.54	2.60	2.55	2.65	2.64	2.53
K2O	0.01	0.02	0.01	0.04	0.02	0.02	0.03
Total:	86.81	86.26	85.71	85.05	85.18	85.49	85.60
Na ratio:[1]	0.81	0.82	0.85	0.84	0.86	0.84	0.81
Fe ratio:[2]	0.58	0.59	0.59	0.57	0.56	0.58	0.58

TM 48W

	C2Rim	C2Core	C3Rim	C3Core	C3Sp3	C4	C4LtBn
SiO2	34.68	34.12	34.58	34.57	34.68	35.00	35.83
TiO2	0.27	0.40	0.25	0.28	0.57	0.15	0.48
Al2O3	30.45	27.15	28.64	29.05	28.25	30.89	27.88
FeO	12.83	14.80	12.55	13.02	14.46	13.81	13.25
MnO	0.06	0.07	0.06	0.09	0.05	0.06	0.10
MgO	5.66	5.54	5.90	5.75	5.58	5.59	6.07
CaO	0.97	1.20	0.85	0.91	1.06	0.92	1.09
Na2O	2.32	2.33	2.56	2.54	2.42	2.39	2.50
K2O	0.02	0.01	0.02	0.01	0.01	0.02	0.01
Total:	87.26	85.62	85.42	86.22	87.07	88.83	87.22
Na Ratio:1	0.70	0.66	0.75	0.73	0.69	0.72	0.69
Fe Ratio:1	0.69	0.73	0.68	0.69	0.72	0.71	0.68

TM 104

	C1Rim	C1	C2Rim	C2Core	C3Altered
SiO_2	34.42	35.08	34.48	34.51	40.89
TiO_2	0.41	0.26	0.55	0.26	0.05
Al_2O_3	28.98	30.31	28.97	29.07	27.06
FeO	10.91	10.16	11.04	10.61	7.90
MnO	0.04	0.06	0.02	0.04	0.16
MgO	7.03	6.82	6.74	6.94	0.12
CaO	1.15	0.99	1.24	1.06	24.42
Na_2O	2.29	2.42	2.30	2.22	0.12
K_2O	0.03	0.01	0.02	0.01	0.20
Total:	85.26	86.13	85.53	84.72	100.9
Na Ratio:	0.66	0.71	0.65	0.67	0.01
Fe Ratio:	0.61	0.60	0.62	0.60	0.97

TM 97

	C1Spl	C1	C3	C3
SiO_2	35.46	35.36	36.89	35.49
TiO_2	0.97	0.58	0.31	0.62
Al_2O_3	32.02	33.12	32.10	30.89
FeO	9.36	9.39	9.30	9.30
MnO	0.02	0.02	0.02	0.02
MgO	5.31	5.11	5.24	5.07
CaO	0.28	0.24	0.25	0.39
Na_2O	2.11	2.22	2.31	2.21
K_2O	0.02	0.01	0.01	0.00
Total:	85.55	86.05	86.43	84.00
Na Ratio:	0.88	0.90	0.90	0.85
Fe Ratio:	0.64	0.65	0.64	0.65

TM 115 Vein

	C1Rim	C1Core	C2xtal	C2xtl2	C2Rad	C2Mat
SiO_2	35.14	35.35	35.92	35.92	35.84	35.58
TiO_2	0.91	0.94	0.16	0.10	0.28	0.28
Al_2O_3	33.39	32.86	35.26	34.51	34.80	35.09
FeO	7.80	8.43	6.95	5.37	5.72	6.67
MnO	0.00	0.03	0.01	0.04	0.02	0.01
MgO	6.24	5.84	5.98	6.85	5.71	6.29
CaO	0.25	0.23	0.11	0.22	0.07	0.28
Na_2O	2.19	2.26	1.96	2.30	2.23	2.15
K_2O	0.03	0.02	0.01	0.00	0.00	0.00
Total:	85.93	85.96	86.37	85.31	84.67	86.37
Na Ratio:	0.85	0.90	0.94	0.91	0.97	0.88
Fe Ratio:	0.60	0.59	0.54	0.44	0.50	0.51

TM 115 Vein, continued

	C3Mat	C3Bld	C4Rad	C4Mat	C4Mat#2
SiO2	35.63	35.89	35.91	35.76	35.80
TiO2	0.27	0.09	0.12	0.19	0.25
Al2O3	34.99	35.34	34.73	36.07	34.84
FeO	7.29	6.98	6.62	7.48	7.62
MnO	0.04	0.03	0.00	0.06	0.03
MgO	5.23	5.39	6.47	5.01	5.48
CaO	0.28	0.07	0.26	0.63	0.29
Na2O	1.79	1.90	2.29	1.54	1.96
K2O	0.03	0.02	0.01	0.00	0.02
Total:	85.54	85.71	86.40	86.76	86.29
Na Ratio:	0.85	0.95	0.89	0.71	0.86
Fe Ratio:	0.58	0.56	0.51	0.60	0.58

Microprobe Data on Chlorite Compositions

	TM 48W		TM 104	
	C1Vein	C1Sp2	C1Chl	C3Chl
SiO2	24.21	24.28	25.09	25.29
TiO2	0.10	0.09	0.05	0.04
Al2O2	19.56	19.94	19.97	20.28
FeO	31.54	32.05	25.22	24.70
MnO	0.64	0.65	0.54	0.52
MgO	11.75	11.56	16.32	16.50
CaO	0.29	0.10	0.00	0.04
Na2O3	0.01	0.03	0.00	0.02
K2O	0.01	0.02	0.03	0.02
Total:	88.12	88.71	87.23	87.43

	TM 116	
	C1ChlSpl	C2Chl
SiO2	25.19	24.85
TiO2	0.05	0.09
Al2O3	21.12	21.27
FeO	27.40	28.26
MnO	0.05	0.07
MgO	13.89	13.09
CaO	0.04	0.04
Na2O	0.06	0.06
K2O	0.02	0.02
Total:	87.81	87.75

Note: C = Crystal
Core= Core of Tourmaline Crystal
Rim= Rim of Tourmaline Grain
Total iron as FeO

1 Analysis by Cambridge Microscan 5 elctron microprobe, Carleton University.

Table 5: Chemistry of Chloritoid-Bearing and Chloritoid-Free Intermediate to Felsic Metavolcanic Rocks[1]. Chloritoid-Free Rock Chemistry from Sage (1987a).

	Chloritoid-free (59 samples)		Chloritoid-bearing (29 samples)		Change
	Mean	Std. Deviation	Mean	Std. Deviation	
SiO_2	75.03	5.60	62.05	10.72	-12.98
Al_2O_3	11.95	1.78	14.81	2.24	+3.03
Fe_2O_3	0.72	0.44	2.11	1.49	+1.39
FeO	1.34	1.21	5.39	2.51	+4.05
MgO	1.06	0.73	1.99	1.95	+0.93
CaO	1.59	1.15	4.03	3.53	+2.44
Na_2O	0.97	1.11	1.28	1.53	+0.31
K_2O	3.13	0.98	0.72	0.60	-2.41
TiO_2	0.25	0.23	0.62	0.31	+0.37
P_2O_5	0.03	0.06	0.05	0.04	+0.02
MnO	0.06	0.06	0.14	0.06	+0.08
CO_2	2.20	1.78	4.51	4.93	+2.31
S	0.03	0.05	0.06	0.09	+0.03
H_2O+	1.35	0.45	1.97	0.62	+0.62
H_2O-	0.08	0.05	0.06	0.04	-0.02
LOI	3.53	1.56	5.87	4.57	
Total	99.78	0.56	99.75	0.57	

---

[1] Lockwood, (1986, p. 86) has completed mass balance calculations comparing least altered and chloritoid-bearing felsic rocks and has detemined that small mass loses have occurred in the chloritoid-bearing rocks.

Table 6: Chemistry of Chloritoid-Bearing and Chloritoid-Free Intermediate to Mafic Metavolcanic Rocks[1]. Chloritoid-Free Rock Chemistry from Sage (1987a).

	Chloritoid-free (65 samples)		Chloritoid-bearing (44 samples)		Change
	Mean	Std. Deviation	Mean	Std. Deviation	
SiO_2	47.98	2.38	45.50	7.08	- 2.48
Al_2O_3	14.00	1.66	13.47	2.30	- 0.53
Fe_2O_3	3.93	1.31	2.22	1.34	- 1.71
FeO	8.38	1.26	9.38	2.39	+ 1.00
MgO	6.32	2.15	4.33	1.58	- 1.99
CaO	8.86	2.14	7.80	3.02	- 1.06
Na_2O	2.15	0.99	0.62	0.81	- 1.53
K_2O	0.10	0.29	0.38	0.40	+ 0.28
TiO_2	1.18	0.30	0.99	0.34	- 0.19
P_2O_5	0.05	0.04	0.04	0.03	- 0.01
MnO	0.21	0.04	0.23	0.10	+ 0.02
CO_2	2.73	2.24	11.23	5.02	+ 8.49
S	0.09	0.24	0.16	0.26	+ 0.07
H_2O+	3.64	2.44	2.45	0.56	- 1.19
H_2O-	0.15	0.07	0.08	0.03	- 0.07
LOI	5.61	2.32	12,40	4.51	+ 6.79
Total	99.45	0.61	98.86	2.32	

[1] Lockwood, (1986, p. 86) has completed mass balance calculations comparing least altered and chloritoid-bearing felsic rocks and has detemined that small mass loses have occurred in the chloritoid-bearing rocks.

Table 7: Chemistry of Altered Volcanic Breccias at the Magpie Iron Range LeClaire Township. Least altered Rock Data from Sage (1987a).

	Least altered rock (59 samples)		Altered rock (16 samples)		Change
	Mean	Std. Deviation	Mean	Std. Deviation	
SiO_2	75.03	5.60	67.53	3.28	- 7.50
Al_2O_3	11.95	1.78	16.22	1.55	+ 4.27
Fe_2O_3	0.72	0.44	0.89	0.44	+ 0.17
FeO	1.34	1.21	1.36	0.76	+ 0.02
MgO	1.06	0.73	0.62	0.46	- 0.44
CaO	1.59	1.15	3.99	1.29	+ 2.40
Na_2O	0.97	1.11	2.85	1.39	+ 1.88
K_2O	3.13	0.98	1.92	0.57	- 1.21
TiO_2	0.25	0.23	0.48	0.08	+ 0.23
P_2O_5	0.03	0.06	0.08	0.05	+ 0.05
MnO	0.06	0.06	0.05	0.03	- 0.01
CO_2	2.20	1.78	1.59	1.00	- 0.61
S	0.03	0.05	0.03	0.08	- 0.00
H_2O+	1.35	0.45	1.51	0.45	+ 0.16
H_2O-	0.08	0.05	0.03	0.04	- 0.05
LOI	3.53	1.56	3.11	1.12	
Total	99.78	0.56	99.14	0.45	

Table 8 : Minor Elements in the Chloritoid-Bearing Rocks Josephine Mine Area, Corbiere Township.

TRACE ELEMENTS (PPM unless noted otherwise)

Sample No.	Ag	As	Au*	Ba	Be	Ce	Co	Cr	Cu	Ga	La	Li	Mo	Nb	Nd	Ni	Pb	Rb	Sb	Sc	Sr	V	Yt	Zn	Zr	Notes:
81RPS-0001	-2	110	-2	280	NA	-35	22	242	52	26	-35	16	-10	6	-20	119	-10		3.5	NA	50	400	5	134	45	* ppb
-0002	-2	2.5	-2	40	2	-35	42	188	126	23	-35	26	-10	-5	-20	98	-10		1.5	35	85	250	5	89	35	A atomic
-0003	-2	17	4	140	3	-35	37	216	78	20	-35	17	-10	-5	-20	101	-10		3.8	30	50	310	5	128	35	absorp
-0004	-2	27	-2	60	NA	-35	26	183	6	22	-35	18	-10	-5	-20	102	-10		4.0	NA	·19	360	5	122	20	X-ray
-0005	-2	9	-2	50	2	-35	35	173	86	18	-35	13	-10	-5	-20	93	-10		1.1	35	90	255	4	76	30	fluore
-0006	-2	10	-2	80	2	-35	21	189	90	24	-35	29	-10	-5	-20	49	-10		4.6	40	6	270	7	126	35	ICP induc
-0007	-2	165	-2	100	NA	-35	74	266	99	29	-35	46	-10	-5	-20	168	12		4.8	NA	80	440	4	107	40	coupl
-0008	-2	52	-2	110	3	-35	67	250	136	22	-35	42	-10	-5	-20	121	-10		1.3	45	7	380	4	320	45	plas
-0009	-2	4	-2	170	3	-35	42	188	91	24	-35	46	-10	-5	-20	82	-10		0.9	40	40	335	5	146	35	
-0010	-2	76	-2	140	3	-35	27	234	53	NA	NA	8	-10	NA	NA	82	-10		4.1	45	35	300	5	127	23	
-0011	-2	110	-2	170	3	-35	65	184	120	NA	NA	19	-10	NA	NA	140	-10		5.0	45	13	355	5	200	50	
-0012	-2	165	-2	110	4	35	95	252	140	26	-35	11	-10	-5	-20	240	-10		9.3	50	60	380	10	220	40	
-0013	-2	240	-2	220	6	NA	25	83	22	24	NA	10	-10	NA	NA	65	-10		12.1	65	16	545	7	240	105	
-0014	-2	155	-2	180	4	60	17	265	39	29	-35	16	-10	5	-20	58	-10		7.0	45	12	390	5	171	95	
-0015	-2	36	-2	190	4	-35	16	103	14	25	-35	20	-10	9	-20	46	-10		4.7	40	25	350	5	120	45	
-0016	-2	18	-2	90	3	-35	13	226	48	NA	-35	6	-10	7	-20	72	-10		6.3	45	8	320	2	178	12	
-0017	-2	215	-2	460	3	41	17	86	28	NA	-35	24	-10	6	-21	20	10		24.4	18	12	300	4	75	95	
-0018	-2	53	-2	20	3	NA	77	233	200	NA	NA	32	-10	NA	NA	250	-10		1.7	35	60	365	12	134	17	
-0019	-2	56	-2	130	3	NA	35	48	136	NA	NA	29	-10	NA	NA	61	-10		2.3	35	35	320	9	270	80	
-0020	-2	17	-2	110	2	NA	33	87	92	NA	NA	34	-10	NA	NA	78	-10		2.7	35	40	270	10	280	85	
-0021	-2	135	-2	100	4	NA	56	287	112	NA	NA	40	-10	NA	NA	230	-10		9.2	65	5	455	2	230	45	
-0022	-2	185	-2	240	4	82	66	248	54	25	-35	24	-10	8	26	123	-10		4.7	30	8	360	2	220	90	
-0023	-2	47	-2	80	3	35	22	78	110	24	-35	30	-10	7	-20	39	-10		5.0	40	24	305	8	170	95	
-0025	-2	90	2	120	5	NA	23	108	225	NA	NA	54	-10	NA	NA	56	-10		5.5	60	11	495	7	200	110	
-0026	-2	86	-2	90	3	38	34	215	36	21	-35	16	-10	-5	-20	52	-10		7.0	45	9	325	4	94	21	
-0027	-2	40	-2	220	2	-35	34	166	110	22	-35	60	-10	-5	-20	106	-10		1.1	35	21	285	5	145	35	
-0028	-2	110	-2	130	NA	-35	42	158	42	21	-35	24	-10	-5	-20	91	-10		5.0	--	25	240	5	164	35	
-0029	-2	52	2	80	2	NA	36	178	98	NA	-35	40	-10	--	NA	95	-10		1.4	35	115	280	5	144	30	
-0030	-2	76	3	70	3	-35	21	183	98	23	-35	44	-10	-5	-20	62	61		8.1	35	23	275	7	102	55	
-0031	-2	105	-2	30	2	-35	39	279	112	15	-35	16	-10	-5	-20	99	-10		4.9	30	6	195	7	136	50	
Limit of detection	2	1	2	10	1	35	5	10	5	5	35	3	10	5	20	5	10		0.1	2	5	5	1	10	1	
Method of analysis	A	A	A	A	ICP	X	A	A	A	X	X	A	ICP	X	X	A	A		A	ICP	ICP	ICP	ICP	A	ICP	

1 Values less than 5 ppm are of lower significance than those greater than 5 ppm (Dr. C. Riddle, Chief Chemist, Geoscience Laboratory)

NA = Not Analyzed

Table 9 : Minor Elements in the Chloritoid-Bearing Rocks Rand No.2, Iron Range, Abotossaway Township. Samples from Drill Core, Superio
and Iron Limited Abotossaway Township, Property (11).

Sample No.	Ag	As	Au*	Ba	Be	Ce	Co	Cr	Cu	Ga	La	Li	Mo	Nb	Nd	Ni	Pb	Rb	Sb	Sc	Sr	V	Y	Zn	Zr	Not
-0032	-2	12	-2	290	1	-35	22	103	140	21	-35	52	-10	10	-20	22	-10	-10	1.4	20	140	300	12	73	24	* p
-0033	-2	6	-2	190	1	49	31	54	95	16	-35	43	-10	4	23	58	-10	-10	1.7	18	110	200	7	90	25	
-0034	-2	2.5	-2	130	1	-35	46	87	80	27	-35	82	-10	19	24	46	-10	-10	0.8	30	125	420	13	160	45	X-r
-0035	-2	7.5	NA	300	1	-35	27	86	18	26	-35	28	-10	8	21	37	-10	-10	1.5	25	80	240	14	140	30	fl
-0036	-2	2	NA	750	2	-35	43	97	141	20	55	12	-10	18	28	62	-10	20	0.1	35	120	300	30	155	75	re
-0037	-2	5	NA	350	2	65	44	124	140	20	-35	16	-10	19	30	72	-10	20	0.2	35	125	300	30	156	75	
-0038	-2	4	-2	280	2	NA	46	134	144	NA	NA	9	-10	21	NA	74	-10	20	0.2	35	115	314	30	158	85	A -
-0039	-2	3.5	NA	250	1	-35	34	69	54	17	-35	68	-10	15	-20	28	-10	-10	0.5	35	65	300	10	107	40	ab
-0040	-2	3	NA	130	1	36	38	43	64	16	-35	102	-10	2	-20	52	-10	-10	1.2	12	90	220	4	122	20	
-0041	-2	38	-2	120	1	NA	35	69	62	NA	NA	36	-10	10	NA	37	-10	10	4.8	25	65	300	8	144	35	ICP
-0042	-2	1	-2	100	-1	-35	6	-5	109	05	-35	3	-10	-1	-20	24	-10	-10	1.3	2	23	12	2	630	24	Ind
-0043	-2	5.5	-2	380	2	55	42	118	146	20	-35	24	-10	19	28	66	-10	20	1.3	35	120	310	30	160	75	cc
-0044	-2	1	-2	350	2	NA	43	116	140	NA	NA	10	-10	19	NA	70	-10	20	0.2	35	135	315	30	142	85	pl
-0045	-2	1.5	NA	350	1	NA	40	99	133	NA	NA	12	-10	14	NA	66	-10	20	0.4	30	125	295	25	145	90	
-0046	-2	85	-2	210	1	-35	52	91	140	24	-35	14	-10	17	-20	40	-10	-10	2.6	40	50	355	5	75	35	
-0047	-2	6	-2	180	1	60	35	71	84	24	-35	72	-10	14	-20	38	-10	10	0.8	35	135	320	4	132	35	
-0048	-2	26	-4	180	1	-35	58	81	110	18	-35	45	-10	12	-20	42	-10	10	3.8	30	95	305	7	200	35	
-0049	-2	12	2	150	1	NA	28	60	38	NA	NA	48	-10	9	NA	22	-10	20	5.1	30	110	275	4	120	35	
-0050	-2	1	-2	380	1	65	8	67	10	17	-35	40	-10	3	28	32	-10	40	3.9	10	175	75	8	112	110	
-0051	-2	-1	-2	180	1	75	-5	70	10	15	37	49	-10	5	24	18	15	30	0.9	10	155	80	8	121	150	
-0052	-2	16	-2	160	1	NA	30	104	78	NA	NA	68	-10	25	NA	36	-10	10	3.5	50	120	445	3	165	35	
-0053	-2	3	-2	190	1	NA	11	70	42	NA	NA	52	-10	8	NA	15	-10	20	2.7	23	130	220	4	150	45	
-0054	-2	12	-2	120	1	-35	34	73	89	18	-35	71	-10	12	26	30	-10	10	1.8	35	85	290	4	170	30	
-0055	-2	13	-2	160	1	43	24	61	47	15	-35	38	-10	8	20	23	-10	10	1.4	30	105	250	4	106	35	
-0056	-2	51	-2	140	1	60	43	75	34	17	-35	27	-10	15	-20	37	-10	-10	1.3	40	90	325	5	150	40	
-0057	-2	2.5	-2	180	1	46	12	53	30	19	48	48	-10	-1	33	35	-10	10	2.3	6	90	75	4	134	120	
-0058	-2	4.5	NA	220	1	80	7	65	10	20	38	48	12	3	24	14	-10	10	3.4	8	140	80	4	73	145	
-0059	-2	4	-2	180	1	60	9	50	28	18	-35	61	12	-1	-20	35	-10	30	3.5	6	140	75	1	52	110	
-0060	-2	24	-2	200	3	NA	10	72	9	NA	NA	41	11	5	NA	30	-10	30	3.8	8	150	85	6	86	130	
-0061	-2	2.5	-2	140	-1	75	19	46	24	15	-35	22	-10	-1	21	46	-10	10	2.9	11	100	70	7	160	100	
-0062	-2	3.5	-2	60	-1	NA	41	82	74	NA	NA	48	-10	8	NA	63	50	-10	0.2	25	100	230	17	136	9	
-0063	-2	4	2	140	1	NA	27	64	29	NA	NA	47	-10	12	NA	39	11	-10	0.4	35	70	340	5	190	55	
-0064	-2	5.5	-2	140	-1	36	14	29	30	5	-35	14	-10	-1	21	58	12	-10	0.4	7	55	50	3	119	40	
-0065	-2	7.5	NA	240	1	-35	13	91	41	25	-35	24	12	24	-20	25	-10	-10	1.4	45	110	410	4	155	40	
-0066	-2	11	NA	200	1	-35	18	68	79	18	-35	28	-10	10	-20	40	14	10	1.3	25	120	300	3	136	35	
-0067	-2	170	-2	90	1	-35	18	5	7	6	-35	22	-10	-1	23	19	-10	-10	5.1	8	85	24	5	93	22	
-0068	-2	53	-2	320	1	75	15	65	8	18	-35	22	10	5	-20	33	-10	20	1.8	9	170	80	7	71	135	
-0069	-2	16	-2	150	1	-35	33	77	51	12	-35	24	10	9	27	27	-10	-10	1.2	30	75	250	4	114	25	
-0070	-2	37	-2	240	1	NA	16	63	14	NA	NA	25	10	3	NA	43	-10	10	1.3	9	170	75	5	97	120	
-0071	-2	87	-2	160	1	-35	57	66	125	17	-35	14	-10	10	-20	36	-10	-10	1.8	35	90	280	4	148	25	
-0072	-2	24	-2	140	1	-35	43	222	20	12	-35	38	-10	11	-20	101	-10	-10	2.8	30	100	315	2	97	9	
-0073	-2	2	-2	80	1	50	41	82	90	19	-35	38	-10	9	-20	55	-10	-10	0.3	30	85	265	15	126	13	
-0074	-2	2	-2	160	-1	-35	38	75	78	18	-35	34	-10	5	20	45	35	-10	0.8	13	50	310	4	140	20	

-0075	-2	1	2	100	-1	N.A	41	53	84	N.A	N.A	78	-10	12	NA	39	-10	-10	0.8	30	85	280	4	134	25
-0076	-2	79	-2	170	-1	N.A	104	84	112	N.A	N.A	43	12	19	NA	60	-10	10	2.5	35	95	345	4	180	30
-0077	-2	4	-2	240	1	45	20	71	50	21	-35	28	-10	16	21	29	11	20	1.6	40	145	320	4	120	17
-0078	-2	36	-2	190	1	N.A	61	47	82	N.A	N.A	18	-10	8	NA	28	-10	10	3.4	30	115	235	5	122	18
-0079	-2	3.5	-2	250	1	-35	12	81	74	20	-35	28	-10	18	27	26	-10	20	3.6	45	120	325	4	145	13
-0080	-2	56	-2	180	1	-35	38	73	16	15	-35	23	-10	12	-20	22	-10	10	2.9	25	120	290	3	109	30
-0081	-2	18	-2	90	1	-35	24	58	75	18	-35	34	-10	11	-20	25	-10	-10	1.5	35	90	285	17	200	25
-0082	-2	18	-2	380	2	70	21	48	19	22	-35	16	14	7	-20	21	-10	20	2.2	11	120	85	6	110	135
-0083	-2	4	-2	280	-1	N.A	12	45	16	N.A	N.A	16	14	-1	NA	26	11	10	1.3	8	100	65	4	102	100
-0084	-2	17	-2	470	1	37	18	50	7	22	-35	20	17	6	29	21	-10	30	5.0	10	105	85	6	98	160
-0085	-2	14	-2	390	1	75	11	42	11	18	-35	12	13	5	23	25	-10	10	2.2	9	145	75	4	79	110
-0086	-2	16	-2	240	1	-35	19	75	34	21	-35	24	-10	12	-20	21	20	10	1.8	30	120	300	3	155	30
-0087	-2	1	-2	160	-1	50	7	44	12	17	-35	28	12	6	32	20	-10	10	2.9	9	140	80	6	79	125
-0088	-2	-1	N.A	280	1	36	9	67	53	19	-35	30	-10	12	-22	19	-10	10	0.7	25	160	275	6	190	12
-0089	-2	80	N.A	300	-1	105	53	40	28	17	-35	25	14	6	22	55	-10	10	9.5	12	140	80	5	70	125
-0090	-2	9	-2	60	1	-35	46	57	86	9	-35	32	-10	11	-24	77	-10	-10	0.5	22	65	245	10	142	19
-0091	-2	2.5	-2	390	-1	44	10	34	7	17	-35	32	10	4	-20	13	-10	30	1.3	9	195	65	7	54	105
-0092	-2	7.5	-2	210	-1	-35	13	17	117	8	-35	18	-10	-1	-20	33	-10	20	0.9	8	80	40	4	78	45
-0093	-2	15	-2	310	-1	70	10	42	6	17	-35	42	11	4	22	22	-10	20	2.0	10	195	70	5	44	105
-0094	-2	1.5	-2	200	-1	-35	38	271	123	13	-35	48	11	15	-20	124	-10	20	1.6	35	190	220	8	134	11
-0095	-2	4.5	5	40	-1	N.A	43	364	50	N.A	N.A	51	10	16	NA	134	-10	-10	0.8	40	75	235	13	116	10
-0096	-2	16	-2	160	1	N.A	27	50	123	N.A	N.A	21	-10	13	NA	25	-10	10	1.1	35	130	230	6	118	20
-0097	-2	31	-2	190	-1	65	66	67	106	17	-35	66	-10	7	28	32	-10	10	1.6	21	60	210	4	106	21
-0098	-2	29	-2	230	1	-35	37	60	34	18	-35	48	-10	15	32	34	-10	10	2.2	35	95	255	7	190	30
-0099	-2	-1	-2	210	1	47	30	66	36	18	-35	37	-10	18	22	24	-10	-10	1.8	40	105	315	5	145	17
-0100	-2	41	-2	240	2	-35	36	81	114	19	-35	42	-10	22	-20	29	-10	10	3.4	40	160	395	6	123	30
-0101	-2	2.5	-2	320	1	90	10	70	24	20	-35	62	14	10	20	30	-10	20	3.0	13	170	95	6	124	140
-0102	-2	2.5	-2	250	1	N.A	-5	65	18	N.A	N.A	66	16	14	NA	19	-10	30	2.2	13	210	120	7	44	180
-0103	-2	9	-2	200	1	-35	29	50	75	13	-35	50	-10	15	-20	39	-10	20	1.7	45	120	265	6	185	30
81RPS-0104	-2	4	-2	190	2	N.A	15	229	18	N.A	N.A	64	17	30	NA	41	-10	20	2.1	40	160	435	6	175	90
Limit of detection	0.1	1	2*	10	1	35	5	10	5	5	35	3	10	5	25	5	10	5	0.1	2	5	5	5	10	1
Method of Analysis	A	A	A	A	ICP	X	A	A	A	X	X	A	ICP	ICP	X	A	A	X	A	ICP	ICP	ICP	ICP	A	ICP

Table 10: Tabulated Diamond Drilling Ego Resources Limited, formerly Ego Mines Limited, Abotossaway Township.

	No. of Holes	Total Footage	Date
PM series[1]	8	505	1959
Ego Mines Ltd. P Series[1]	9[2]	794	1964
Ego Mines Ltd. PV, PS etc.[1]	15	857	?
Ego Mines Ltd.	24 (1-24)	16,437	1959
	25 (25-49)	9,759	1960-1961
	68 (50-117)	25,885	1965-1966
	6 (118-123)	2,889	1969
	123	54,970	
Ego Mines Ltd. G Series	2	218	1976
United Canso Oil and Gas Ltd.	20	6,767	1980

[1] Packsack holes, location unknown.

[2] Drill records incomplete. No record for holes 6 thru 9 inclusive.

Table 11: Tonnage Estimates using diamond drilling data on Various Zones on the Ego Mines Limited Property (Vallance 1965a, p.6).

Zone	Tons	Copper(%)	Gold(oz/ton)
West Central	8,958	1.43	0.36
Central	100,561	1.96	0.13
North Porphyry	58,194	1.62	0.13
South	12,102	1.22	0.20
C	73,399	1.99	0.06
Total	253,204		

Table 12: Drill-Indicated Grade and Tonnages in Various Zones, Ego Mines Limited (Vallance 1971, p.16).

INDICATED				DILUTED INDICATED		
Source	Tons	Grade				
		%Cu.	Oz.Au.	Tons	%Cu.	Oz.Au.
South Vein	12,102	1.22	0.20	13,917	1.08	0.18
North Porphyry	58,194	1.62	0.13	66,923	1.43	0.11
Central	100,561	1.96	0.13	115,645	1.73	0.11
West Central	8,958	1.43	0.36	10,302	1.27	0.31
South West	27,419	1.64	0.31	31,532	1.45	0.27
MAIN ZONE	207,234	1.75	0.17	238,319	1.54	0.15
C Zone	71,063	2.06	0.06	81,722	1.82	0.05
Probable	17,008	1.71	0.05	19,559	1.66	0.04
'C' ZONE	88,071	1.99	0.06	101,281	1.79	0.05
W 8	39,899	1.91	0.08	45,884	1.69	0.07
TOTAL	335,104	1.75	0.13	385,484	1.62	0.114

Table 13: Tabulated gold values in excess of 0.10 ounces per ton for Farquhar Vein (AFRO, Toronto)

Golden Algoma Mines Limited[1]

Hole	Intersection (feet)	Ounces/ton
1	143	0.76
4	151.2 to 153.6	0.20
5	241.6 to 246.4	0.39
6	148.0 to 150.2	0.10
14	118.5 to 123.0	0.10

Rio Tinto Canadian Exploration Limited

Hole	Intersection (metres)	Ounces/ton
1	71.15 to 71.70	0.19
	71.70-72.20	0.89
	71.15-72.20	0.52
3	62.47-62.94	0.31
	68.43-68.94	0.22
6	20.00-20.70	0.59

[1] Location of holes unknown.

Table 14: Conductors Identified by Manwa Exploration Services Limited for International Corona Resources Limited, Abotossaway Township. Locations Approximated on Accompanying Compilation Map, Analysis reported by the company, (Neelands et al.).

Conductor	Identified	Location	Comments
3430F,G, 3440D,E,F 3450E,F,G,H, 5020A	Chert magnetite iron formation, minor graphite. Up to 20 percent pyrite, pyrrhotite	43A	Dreany Iron Range. Two rock analysis 482 and 162 ppm Zn, one at 132 ppm Cu, one at 17 ppb Au
3470H- 3481A	Chert magnetite iron formation within mafic volcanic. One to 3 percent pyrite	43B	Segment of Dreany Iron Range
3540C- 3580D	Chert magnetite iron formation	43C	Rock analyses (6 samples) 100 to 124 pm Zn, 101 to 215 ppm Cu, and one sample with 13 ppb Au.
3550G	Intermediate tuff with massive sulphides in siliceous zone. Twenty percent pyrrhotite and pyrite	43D	Rock sample returned 751 ppm Zn, 129 ppm Cu
3740C			Probably segment of Reau-Mary Iron Range
3740E	Sulphide iron formation with 3 to 8 percent pyrite in chert	43E	Reau-Mary iron Range. One sample 998 ppm Zn, 116 ppm Pb, 529 ppm Cu. Several sample 134 ppm Zn, 153 ppm Pb.
6010C 6030H	Chert sulphide iron formation with 20 percent pyrite	43F	Extension of Reau-Mary Iron Range. One sample returned 40 ppb Au. Four samples 70 to 330 ppm Cu and 126-148 ppm Zn.
6040B, 6030F- 6050D, 6040E,F	Chert sulphide iron formation	43G	Copper and zinc in 7 rock samples varied from 140 to 1700 ppm, lead 100 to 135 ppm. One sample gave 59 ppb Au. Extension of Reau-Mary Iron Range
6050D- 6060I	Chert sulphide iron formation graphite	43H	Extension of Reau-Mary Iron Range. Four samples varied from 108 to 1390 ppm Zn and three samples varied from 140 to 1010 ppm Cu.
3420A,C 3430A,B	Not Identified	43I	Possibly iron formation of Rutledge Iron Range
3460D- 3470D	Not Identified	43J	Probably magnetic iron formation. Possible segment of Dreany Iron Range

Table 15: Assay Data on Grab Samples Collected from Trenches On Kozak Property Near Shaft. (Analysis by Geoscience Laboratories, Ontario Geological Survey).

Sample Number	Au (oz/ton)	Ag (oz/ton)
W576-54A	0.22	9.24
W576-54B	0.21	13.09
W576-54C	0.12	15.54
W576-56A	0.02	2.22
W576-56B	0.02	2.14
W576-56C	0.30	29.24
W576-66A	0.15	5.31
W576-66B	0.04	12.50

Table 16: Tabulated Diamond Drill Hole Data for Kozak Property As On Record in AFRO, Toronto

Company	Holes	Date	Footage
Adonis Mines Limited	71	1960-1961	17,440.0
Lake Kozak Mines Limited	24	1967	3,558.6
Golden Spoke Mines Limited	13	1980-1981	4,241.3
Total	108		25,239.9

Table 17: Drill Indicated Estimates of Grade and Tonnage for Kozak Property (from Anonymous 1981, p.1).

Zone	Au oz/ton	Ag oz/ton	Average width	Length	Depth	Estimated Tonnage
1c	.044	1.5	7.7	100	180	11,550
2b	.057	2.78	5.6	120	100	5,600
2	.06	3.56	17.8-50	40	50	7,616
3a	.04	1.41	9.0	50	225	8,437.5
4d	.067	1.51	5.7	125	200	11,875
4	.05	1.33	24	120	70-200	62,875
5	.1	6.0	17.3	125	100	18,542

Table 18: Tabulated Bulk Samples of Norgold Mines Limited as Compiled by C.P. Robertson 1959 (AFRO, Toronto). Assays at $35.00 U.S.

100 foot level

Distance west of shaft	length (ft)	Tonnage	Assay($)
250	110	46.30	0.90
390	123	49.18	2.57
540	86	45.17	1.12

200 foot level[1]

Distance west of shaft	length (ft)	Tonnage	Assay($)
430	100	32.79	0.70
545	140	110.45	2.12
870	50	14.98	1.22
1150	45	28.30	1.05
1330	75	---	---
1425	72	55.62	2.62
Total		382.79 tons at 1.74	

At 35.00 U.S. per ounce gold the grade is estimated at 0.05 ounce gold per ton.

[1] Samples at 1330 and 1425 combined for a total tonnage of 55.62.

Table 19: Assay Values In Excess of 0.10 Ounces Gold Per Ton Reported On Diamond Drill Logs of Golden Algoma Mines Limited (AFRO, Toronto).

Hole	Length (not true width)	Assay ounces/ton
3	44.6-45.6	0.10
4	140-143	0.24
	145-150	0.17
5	166-170	0.17
9	625-631	0.24
10	340-345	0.13

Table 20: Tabulated Drilling Summary on Rand No.2 Iron Range. Data from AFRO, Toronto.

Company	Hole No.	Date	Footage
Morrison	1 thru 18[1]	1915	2,917.5
Aldermac Copper Corporation Limited	19 thru 28[2]	1941	4,218
Superior Iron and Acid Limited	68-1 thru 68-18	1968	5,322
	69-1 thru 69-43[3]	1969	16,820
Total	85 holes		29,277 feet

[1] Drill logs sketchy

[2] Drill logs not available

[3] Holes 29, 32, 37, and 41 not drilled; logs for most holes missing.

Table 21: Calculated Tonnage and Grade For Pyrite and Siderite Ore for Aldermac Copper Corporation Limited by Hawley (1942b, p.22, 23) (AFRO, Toronto).

Summary of Tonnage and Grade - Pyrite Ore

Probable Ore in wider bands

Central Section - South Band -	2,892,090 tons @ 49.65% pyrite
Tunnel Section - North Band -	460,000 tons @ 63.9% pyrite
Total	3,352,090 tons @ 51.6% pyrite

Probable Ore in Narrow Bands

Central Section - South Band -	291,500 tons @ 47.5% pyrite
Tunnel Section - North Band -	107,700 tons @ 61.5% pyrite
Total	399,200 tons @ 51. % pyrite

Possible Ore in Wider Bands

Central Section - South Band -	545,500 tons est. @ 50.0 % pyrite
Tunnel Section - North Band -	207,000 tons est. @ 50.0% pyrite
Western Section - South Band -	891,100 tons est. @ 50.0% pyrite
Total	1,643,600 tons est. @ 50.0% pyrite

Probable - Low Grade - Wide Band - Hole #22 = 150,000 tons @ 38.2% pyrite

GRAND TOTAL - over 5,000,000 tons of 50 per cent pyrite

Summary of Tonnage and Grade for Siderite Ore;
Central and Southeast section of the South Band, 2,415,800 tons grading 27.05 percent iron

Table 22: **Reserve Calculations of Pyrite Within Rand No.2 Iron Range As Proposed by Middleton and Thompson (1969, p.4) For Duncan R. Derry Limited For Superior Acid and Iron Limited (AFRO, Toronto).**

A. ABOVE A.C.R. TRACK (FROM ZERO ELEVATION TO SURFACE)

Probable Ore

	Sort Tons	Grade % Pyrite
North Band - Tunnel Segment	713,400	55.8
South Band - East & Central Segments	3,670,300	48.7
Total	4,383,700	49.9

Possible Ore (Drill indicated)

	Sort Tons	Grade % Pyrite
North Band - West and Tunnel Segment	172,800	55.7
North Band - Central Segment	400,000	45.0 (est.)
South Band - Western Segment	960,800	45.0 (est.)
Total	1,543,600	45.1

B. BELOW A.C.R. TRACK (FROM ZERO ELEVATION TO 300 FOOT ELEVATION)

	Sort Tons	Grade % Pyrite
Probable Ore	none	-

Possible Ore (Geological indicated)

	Sort Tons	Grade % Pyrite
North Band - Tunnel Segment	1,150,500	56.8
North Band - Central Segment	400,000	45.0 (est.)
South Band - Eastern & Central Segments	3,582,100	49.9
South Band - Western Segment	1,385,000	45.0
Total	6,517,600	49.7

C. TOTAL POSSIBLE ORE

	Sort Tons	Grade % Pyrite
Above Track	1,543,600	45.1
Below Track	6,517,600	49.1
Total Combined	8,061,200	48.5

Table 23: Calculated Grade and Tonnage Figures For Rand No.2 Iron Range As Prepared By Esson (1969) for Superior Iron and Acid Limited (AFRO, Toronto).

Probable Ore	Tons	% S	
Tunnel Band	1,290,000	28.7	
North Central	435,000	21.6	
South, East & Central	4,500,000	25.7	
Total	6,225,000	26.0	(Weighted)
Possible Ore			
Tunnel Band, below track	1,750,000	28%	
North Central, below track	400,000	21	
North Central, above track	298,000	22	
South, East & Central, below track	4,500,000	26	
South, East & Central above track	420,000	23	
South Western, above & below track (after Hawley & Campbell)	1,000,000	27	(est)
	8,368,000	26	(weighted)

TOTAL, PROBABLE & POSSIBLE, 14,593,000 Tons @ 26% S.

Table 24: Possible Siderite Orebodies in Bartlett Iron Range Based On 1946-1947 diamond drilling by Algoma Steel Corporation Limited (AFRO, Toronto)

Ore Bodies	Depth	Width	Length	Assay				
				Fe	SiO_2	S.	Mn.	Sinter
A	450	75'	890'	40.50	6.97	10.42	2.18	53.6%
B	270	47'	730'	39.72	6.42	9.57	2.23	53.5%
C	310	45'	310'	39.93	6.25	5.84	2.29	52.0%
D	450	45'	800'	38.99	5.69	7.02	2.23	52.5%

Tonnage - 1,000,000 Open Pit
6,831,635 to 450' (including open pit).

Table 25: Tabulated Gold Assays On Grab Samples Taken From Edwards Gold Occurrence. Assays By Geoscience Laboratories, Ontario Geological Survey.

Sample No.	Gold (oz/ton)	Rock Type
Ed-1	Trace	Laminated mafic tuff with pyrite, magnetite
Ed-2	0.03	Sugary quartz with up to 30% pyrite
Ed-3	0.04	Fifteen cm wide siliceous band with 50% pyrite
Ed-4	0.04	Mafic tuff with some pyrite
Ed-5	0.19	Sugary quartz with 20 to 60% pyrite
Ed-6	0.20	Sugary quartz with 60 to 70 % pyrite
Ed-7	0.39	Sugary quartz with 40 to 50 % pyrite, pyrite crystals up to 5 mm
Ed-8	0.19	Sugary quartz with 40 to 50% pyrite
Ed-9	0.13	Sugary quartz with 50% pyrite
Ed-10	trace	Quartz vein 1 m wide
Ed-11	trace	Irregular pods of quartz in mafic tuff
Ed-12	trace	Mafic tuff with disseminated pyrite in grains up to 1 mm
Ed-13	0.07	Mafic tuff with quartz containing 10 to 15% pyrite
Ed-14	Trace	1 m wide quartz carbonate zone
Ed-15	Trace	Mafic tuff with 5 to 10% pyrite on north side of quartz carbonate zone

Table 26: Tabulated Gold Values in Excess Of 0.10 Ounces Per To Resulting From Diamond Drilling By Hollinger Consolidated Gold Mines Limited, Edwards Gold Occurrence (AFRO, Toronto).

Hole	Intersection	Au (oz/ton)	Ag (oz/ton)
1	52-53.5	3.09	0.59
8	53-56	0.24[1]	1.46

---

[1] Two values are given on the drill logs for this interval, 0.24 and 0.04 ounces per ton.

Table 27: Conductors Identified By Manwa Exploration Services for International Corona Resources Limited, Corbiere Township. Locations Approximate on Accompanying Compilation Map (Neelands et al. 1984a).

Conductor	Identified	Location	Comments
3820H 3840G	carbonated siliceous sulphide zone	44A	Big Lake Iron Range. Ten rock samples 108-153 ppm Pb; 3 samples 155-320 ppm Cu, 2 samples 648,270 ppm Zn, 2 samples 16, 25 ppb Au
3860D	chert magnetite iron formation	44B	Two rock samples, 121,352 ppm Zn; 138,159 ppm Pb; 88,102 ppm Mo. Probably Newric Iron Range
6010D 5470E	Chert sulphide iron formation	44C	Cline Lake Iron Range, one sample 164 ppm Zn, 107 ppm Pb
6140M 6180K	unknown	44D	undescribed rock, specimen returned 97 ppm Cu

Table 28: Summary Of Surface Diamond Drilling On the Josephine Iron Range (AFRO, Toronto).

Company	Hole Series	No. of Holes	Date	Total Footage
Wiley, H.A.		3	1900	618
Lake Superior Corporation		21	1901-1903	11,788
Algoma Steel Corporation Limited		5	1913-1914	4,817
Michipicoten Iron Mines Limited	"S"	9	1941	6,494.2
	"J"	18[1]	1950-1951	8,822
Algoma Steel Corporation Limited	"J"	4[2]	1951	3,087
Total		60		35,626.2

[1] Two holes abandoned, holes numbered J-1 thru 16.
[2] Holes numbered J-17 thru J-20'.

Table 29: Tabulated Tungsten Assay Values on O'Reilly Scheelite Vein Quartz, Geoscience Laboratories, Ontario Geological Survey).

Sample	Tungsten (ppm)	Rock Type
OR-1	<50	25 cm of milky quartz with minor ankerite
OR-2	<50	Two thirds of a 35 cm wide milky quartz vein with minor ankerite
OR-3	<50	Granular milky quartz with iron stain
OR-4	6.5%	10 cm of granular white quartz vein with minor carbonate and traces of pyrite
OR-5	275	Granular milky quartz vein material with iron stained carbonate
OR-6	<50	Carbonated sericite schist with 1 percent pyrite
OR-7	<50	Chip sample over 1 m of vein material. Contains vein quartz and ankeritic carbonate

Table 30: Tabulated Grab Sample Assays For Soocana-Holdsworth Gold Occurrence, Corbiere Township Geoscience Laboratories, Ontario Geological Survey).

Sample	Gold (ounces/ton)	Description
SOH -175-1	0.01	Irregular 15 cm milky quartz vein. Carbonate alteration in walls of vein.
SOH -175-2A	0.13	Ten centimeter milky quartz veins. Strike 305, dip 60 north.
SOH -175-2B	trace	Quartz carbonate rock.
SOH -175-2B	trace	Quartz carbonate rock.
SOH -175-3A	0.01	North vein, 100 cm wide, striking 310, dipping 75 south. Sample of milky quartz.
SOH -175-3B	trace	Same as SOH 175-3A
SOH -175-3C	trace	South vein, 75 cm wide striking 220, irregular dip, sample of milky quartz.
SOH -175-3D	0.02	Same as SOH 175-3C.
SOH -175-4A	trace	Carbonate plus quartz vein material
SOH -175-4B	trace	Milky quartz vein
SOH -175-6A	3.28	Milky quartz vein with 1% chalcopyrite, visible gold.
SOH -175-6B	0.01	Milky quartz vein
SOH -175-7	0.55	Milky quartz vein with traces of chalcopyrite and pyrite
SOH -175-8A	trace	Barren milky quartz vein. Sample from vein section 130 cm wide.
SOH -175-8B	trace	Barren milky quartz vein.
SOH -175-8C	trace	Sample from 30 cm wide area of quartz and carbonate along north-side of vein.

Table 31: Chemical Analyses of Alice Lake Iron Range Magnetite (Collins and Quirke, 1926, p.97).

	Hole No.1	Hole No.2	Hole No.3	Hole No.5	Hole No.6
Iron	35.43	39.07	42.57	38.85	32.37
Silica	17.13	21.92	15.80	19.47	20.35
Sulphur	4.47	9.05	7.74	2.29	4.918
Phosphorus	0.012	0.017	0.027	0.025	0.023
Alumina			1.66	2.50	4.20
Lime			5.17	5.77	6.22
Magnesia			3.99	3.98	3.49
Manganese			1.79	2.20	1.02
Loss on Ignition			3.03	3.90	5.90

Table 32: Diamond Drilling With Assays Compiled From Maps of the Algoma Steel Corporation Limited, Godon Lake Iron Range, LeClaire Township (AFRO, Toronto).

Hole	Length (ft)~~1~~		Intersection (ft)[1],[2]	Fe (%)	SiO2 (%)
1	~~503~~	475	170-327	17.60	54.40
2	~~350~~	346	102-250	14.70	56.50
3	~~517~~	508	252-490	13.99	64.09
4	~~321~~	350	160-270	12.40	71.45
5	~~390~~	382	48-368	17.28	51.70
6	~~470~~	467	25-360	19.06	50.23
7	~~630~~	616	285-570	17.56	51.71
Total	~~3181~~	3164			

[1] Scaled from sketch maps
[2] Intersection not true width

Table 33: Conductors Identified by Manwa Exploration Services for International Corona Resources Limited, LeClaire Township. Locations Approximate On Accompanying Compilation Map (Neelands et al. 1984a, 1984b).

Conductor	Identified	Location	Comments
3310B-3320C	Graphitic shale with pyrite within mafic metavolcanics at granodiorite contact	45A	One rock specimen returned 354 ppm Zn, 163 ppm Cu
3380K	Wide zone of graphite in metasediments	45B	Close to Umex D.D.H. Wa-3 (Location 37-A) One sample returned 537 ppm Zn, 44 ppm Au
3360B-3370B	Graphitic shale with 3 to 5 pyrite	45C	One sample returned 105 ppm Cu
3470I 3481D	chert magnetite iron formation with graphite and pyrite	45D	Rock sample returned 132 ppm Cu, 220 ppm Pb, 183 ppm Zn, 35 ppb Au
3500G	Not identified	45E	Two pyrite samples from area returned 402,604 pm Zn, 514,493 ppm Cu, 427,240 ppm Pb
3520E-3540E	Not identified	45F	Within mafic metavolcanics
3600B	Not identified	45G	Within mafic-metavolcanics but could be on or close to metavolcanic metasedimentary contact

Table 34 : Minor elements, Magpie Iron Range Siderite

Sample No.	Ag	As	Au*	B	Ba	Be	Co	Cr	Cu	Ga	Li	Mo	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	Y	Zn	Zr	Note
83RPS-0317	-2	30	18	-20	40	-1	-5	-5	6	-1	-3	-10	8	-5	-10	3.3	5	-.08	50	65	10	63	-1	* ppb
-0318	-2	120	19	-20	20	-1	-5	-5	7	-1	-3	-10	8	-5	-10	7.2	6	-.08	70	60	13	81	-1	A-atom
-0319	2	1920	5	-20	20	-1	-5	-5	6	-1	3	-10	9	-5	-10	5.8	6	-.08	45	75	12	90	-1	abso
-0320	-2	120	8	-20	30	-1	-5	-5	5	-1	3	-10	8	-5	-10	1.8	5	-.08	30	60	9	59	-1	
-0321	2	15	2	-20	30	1	-5	-5	6	-1	-3	-10	8	-5	12	2.3	6	0.9	75	70	13	78	-1	ICP -
Method of analysis	A	A	A	ICP	A	ICP	A	A	A	OE	A	ICP	ICP	A	A	A	ICP	A	ICP	ICP	ICP	A	ICP	Indu coup plas
Limit of detection	0.1	1	0.1	20	10	1	5	10	5	1	3	10	5	5	10	0.1	2	0.8	5	5	5	10	1	OE - o e

Table 35: Analytical Data Magpie Mine, Presented by the Ontari Iron Ore Committee (1924, p.160).

An average of the analyses of 157 samples taken during development o the 1st and 2nd levels is as follows:

	Per cent
Iron	36.79
Silica	5.70
Sulphur	0.78
Phosphorus	0.012
Manganese	2.00 to 3.00
Loss on ignition	28.01

The following analyses show the average composition of the roasted o e shipped in 1914 and 1916:

	1914 per cent	1916 per cent
Iron	50.60	50.10
Silica	9.39	9.14
Sulphur	0.25	0.136
Phosphorus	0.011	0.013
Alumina	1.02	1.28
Lime	8.79	7.96
Magnesia	7.05	8.04
Manganese	2.71	2.74
Loss by ignition	Nil	Nil

Shipments from the Magpie during the years 1913-1921 were:

	Tons
1913	22,327
1914	109,838
1915	129,722
1916	210,522
1917	197,561
1918	168,906
1919	189,962
1920	106,241
1921	58,401
Total	1,193,480

1 Shipments are of sinter and not siderite. It takes approximatel 1.4 tons of siderite ore to make one ton of sinter. It is not kno n whether the sinter produced at Magpie from Helen Iron Range ore was deducted from the shipments of sinter attributed to the Magpie Min

Table 36: Conductors Identified by Manwa Exploration Services for International Corona Resources Limited, Musquash Township. Locations Approximate On Accompanying Compilation Map (Neelands et al. 1984a).

Conductor	Identified	Comments	Location
3620D-3630D	unknown	Within mafic metavolcanics	46A
3640A	unknown	Within mafic metavolcanics	46B
3680A-3690A	graphite pyrite horizon within mafic metavolcanics	Along Mildred Lake Fault	46C
3700K-3710B	unknown	Suspect iron formation but could be graphitic metasediment	46D
3730A-3750B	pyrite and graphite	One sample returned 173 ppm Zn, 88 ppm Pb, at contact with thin felsic metavolcanic unit and mafic metavolcanic	46E
3850D	unknown	Possibly chert magnetite iron formation. Rock sample in area returned 33 ppb Au, 184 ppb Cu, 290 ppm Zn	46F

Fig. 2

FELSIC INTRUSIVE, HAWK LAKE GRANITE AREA II

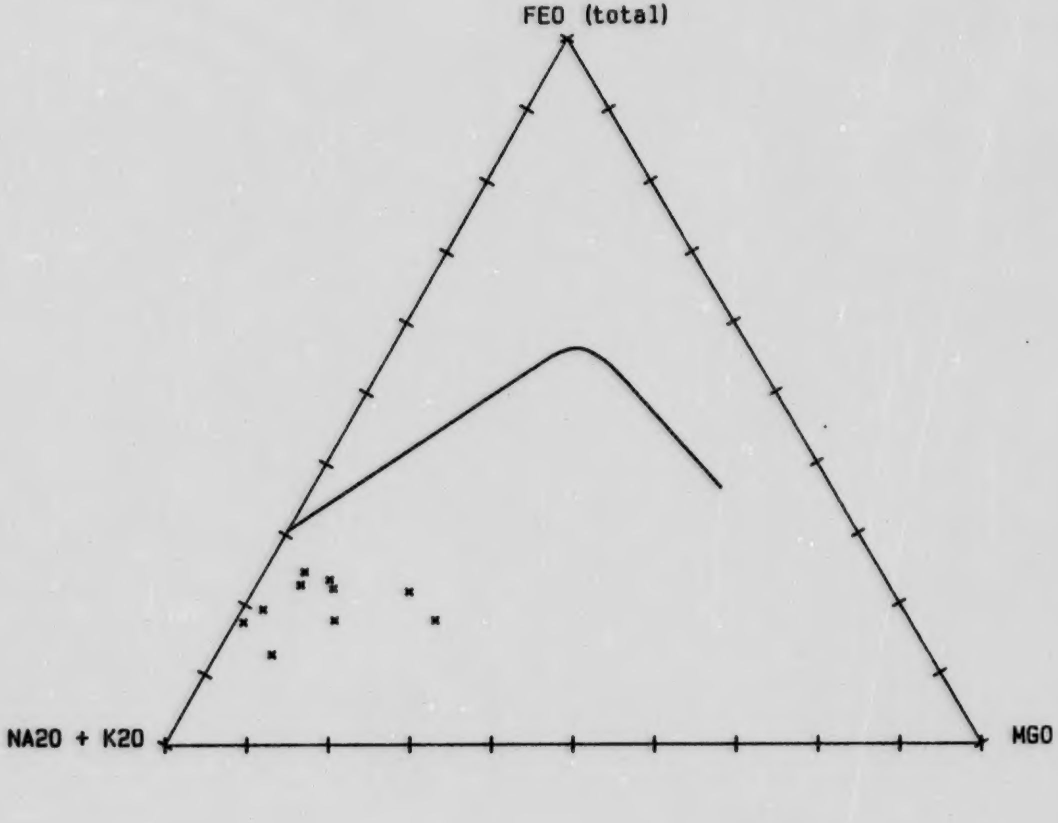
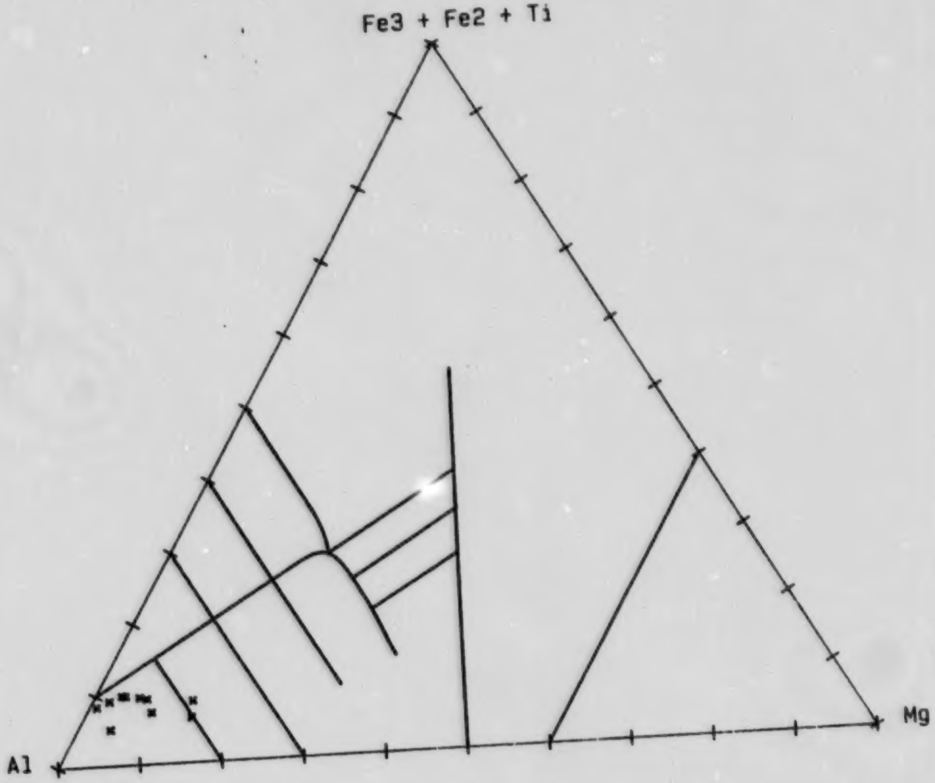


Fig. 3
FELSIC INTRUSIVE HAWK LAKE STOCK AREA II



SAGE

Fig. 4
MAFIC VOLCANICS CYCLE 2, AREA II

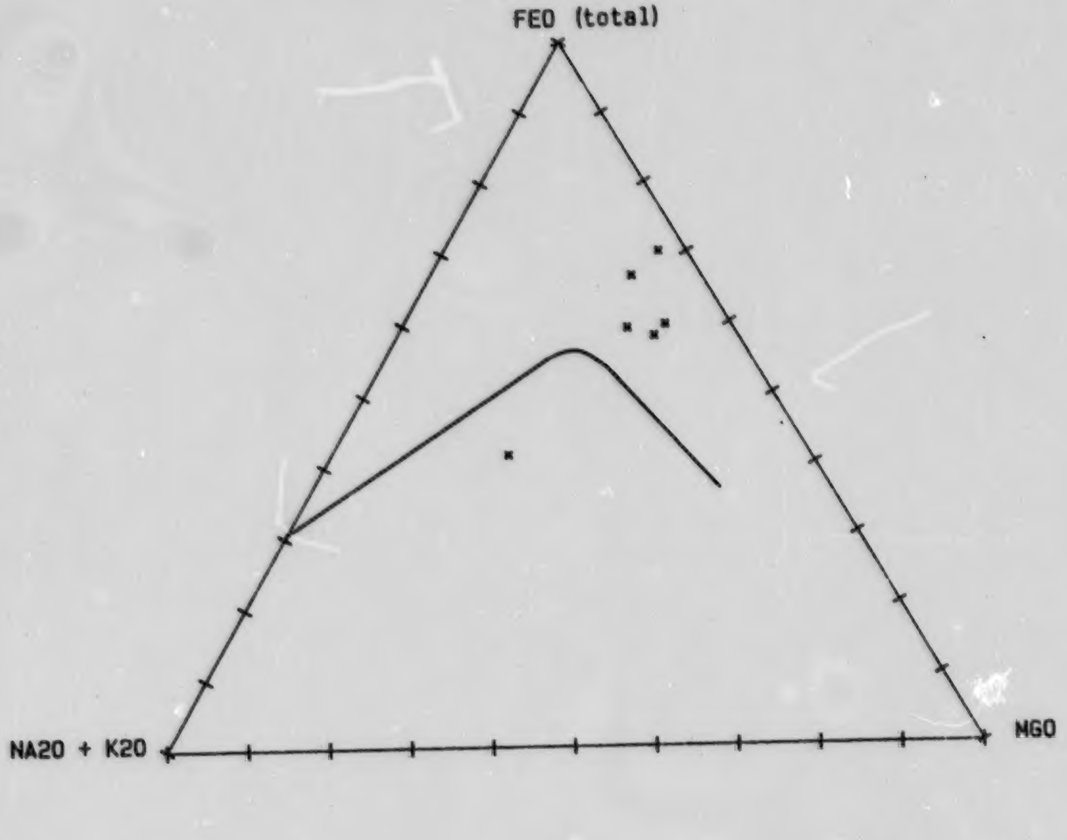


Fig. 5
MAFIC VOLCANICS CYCLE 2, AREA 11

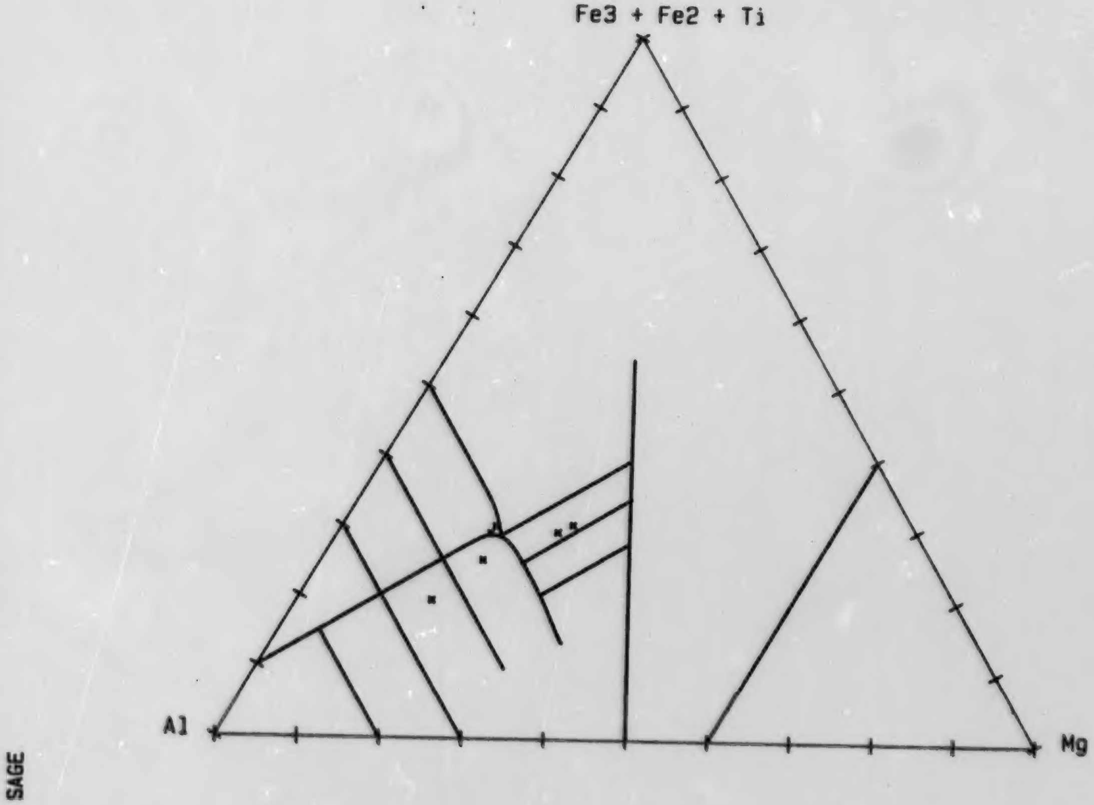


Fig. 6
FELSIC VOLCANICS AREA II

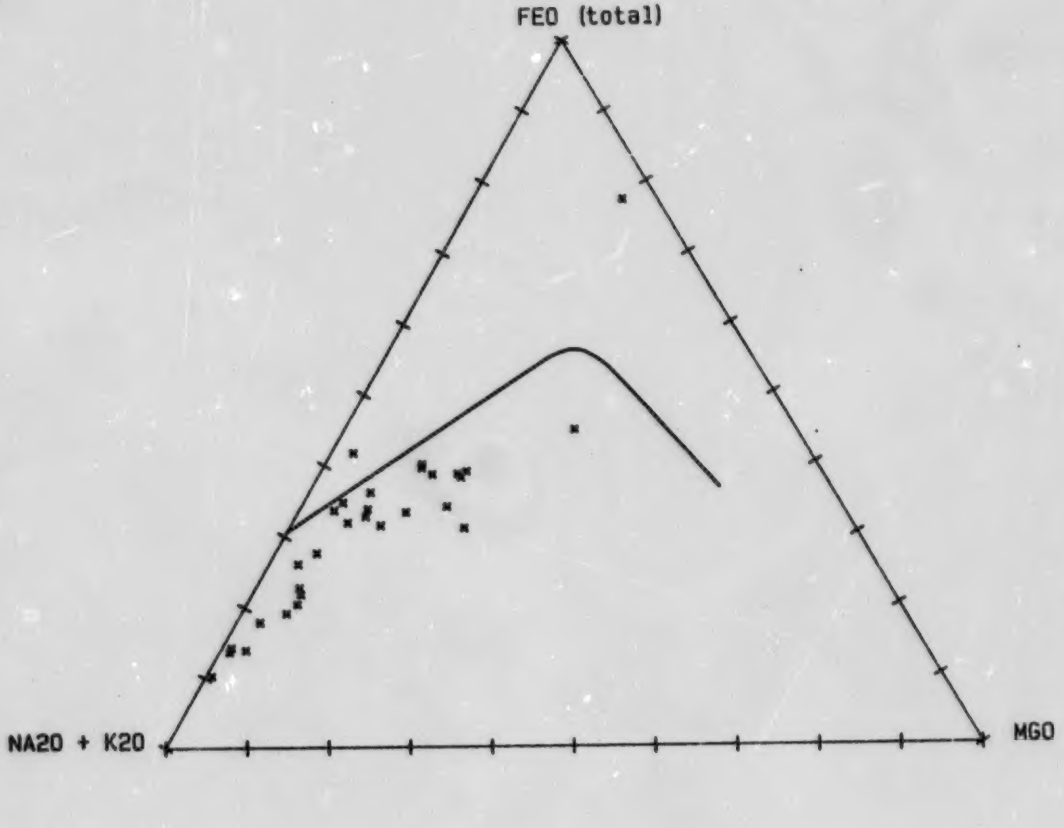


Fig. 7
FELSIC VOLCANICS AREA II

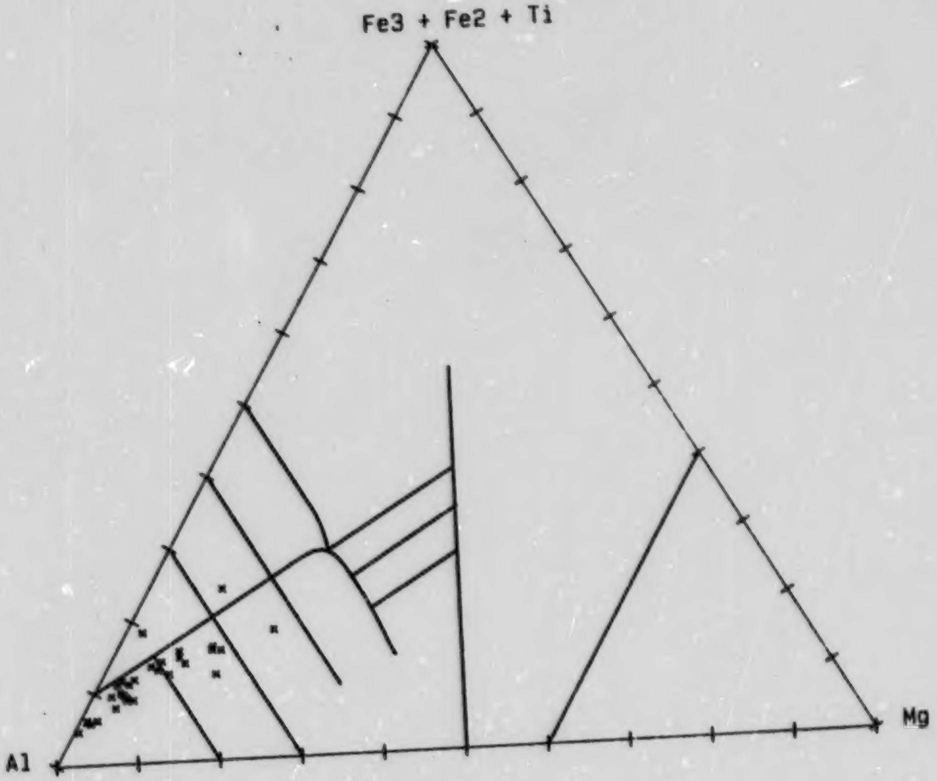
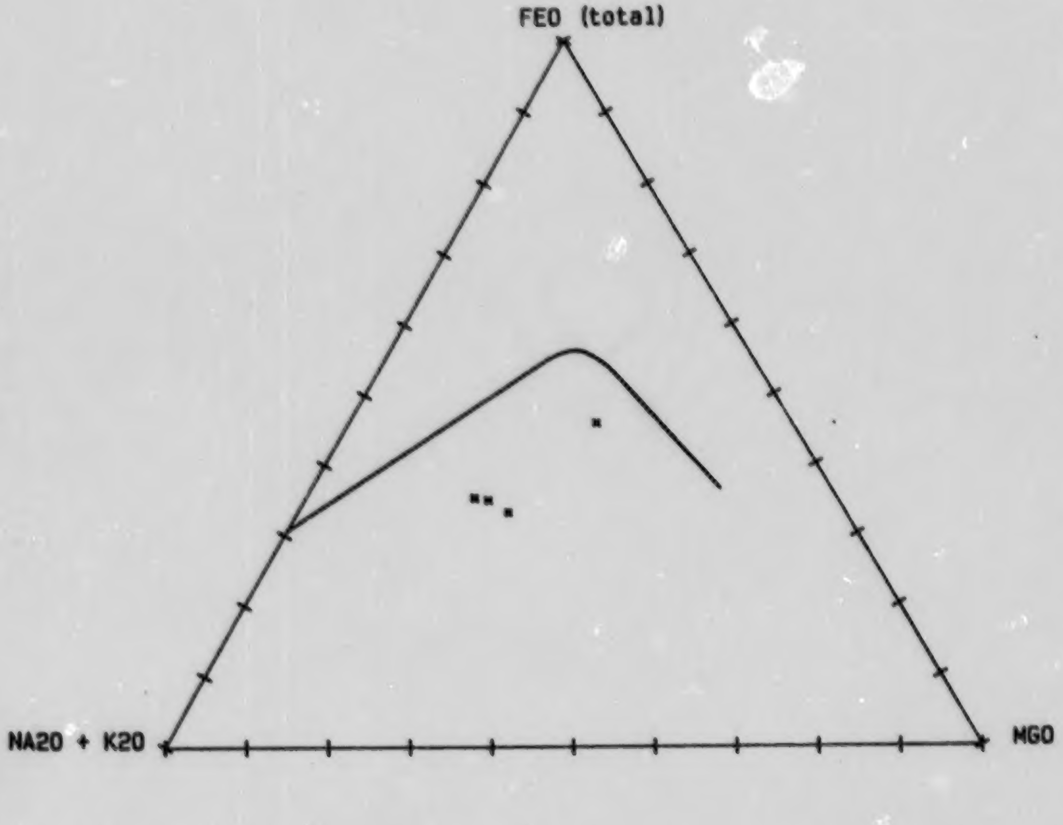


Fig. 8
METASEDIMENTS AREA II



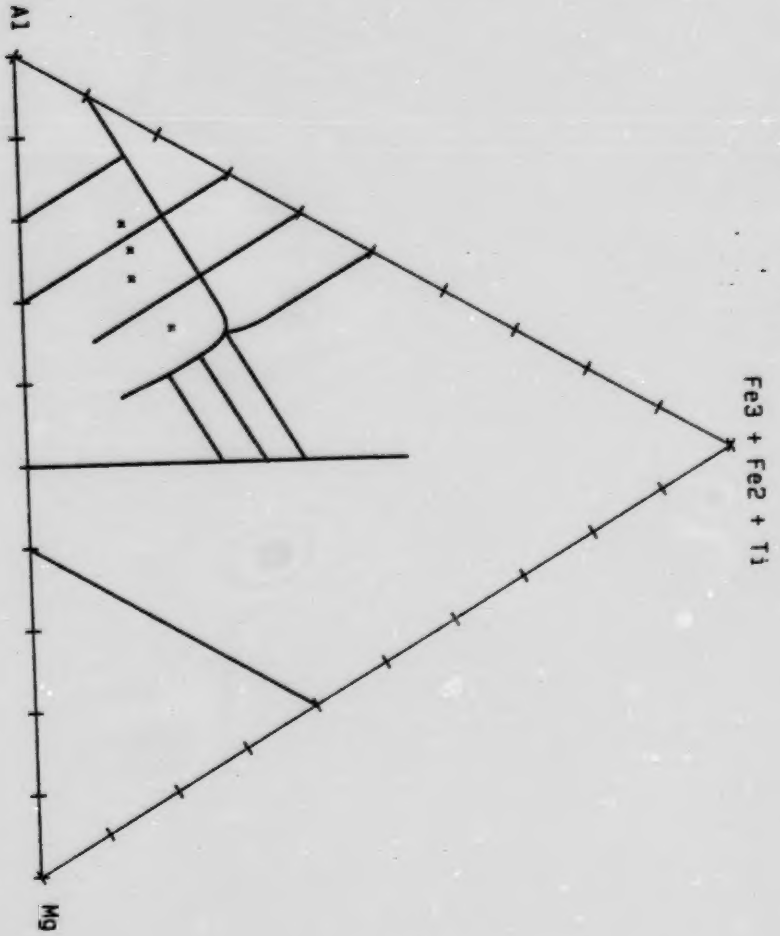


Fig. 9
METASEDIMENTS AREA II

Fig. 10
MAFIC INTRUSIVES AREA II

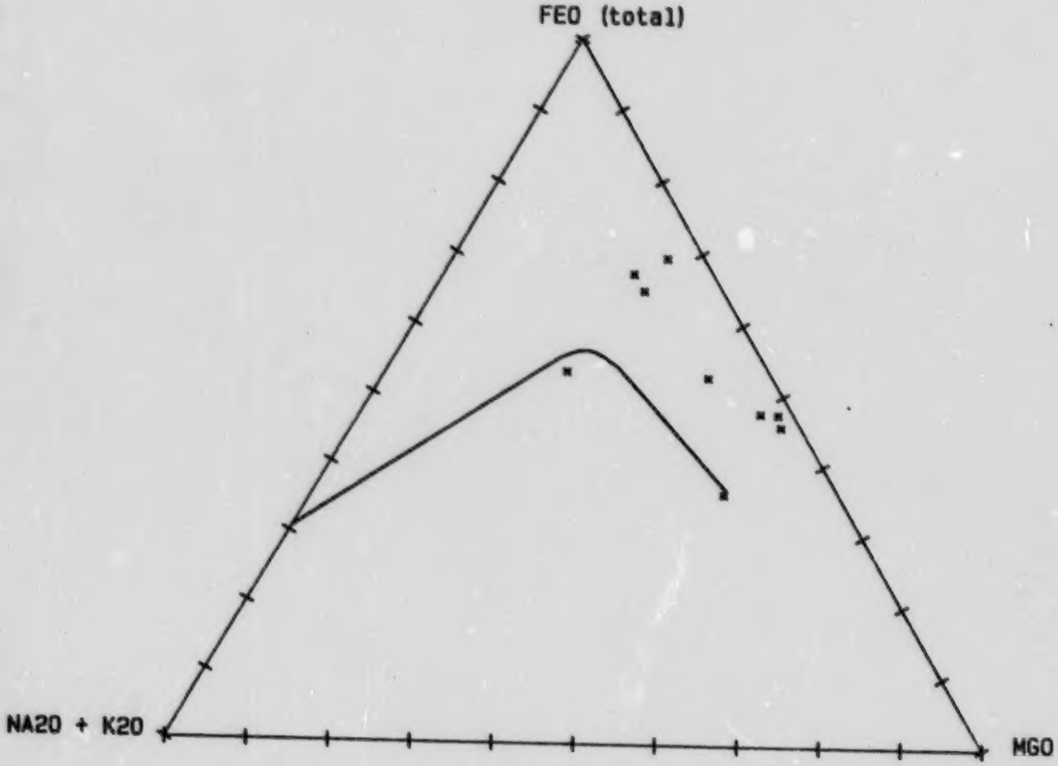


Fig. 11
MAFIC INTRUSIVE., AREA II

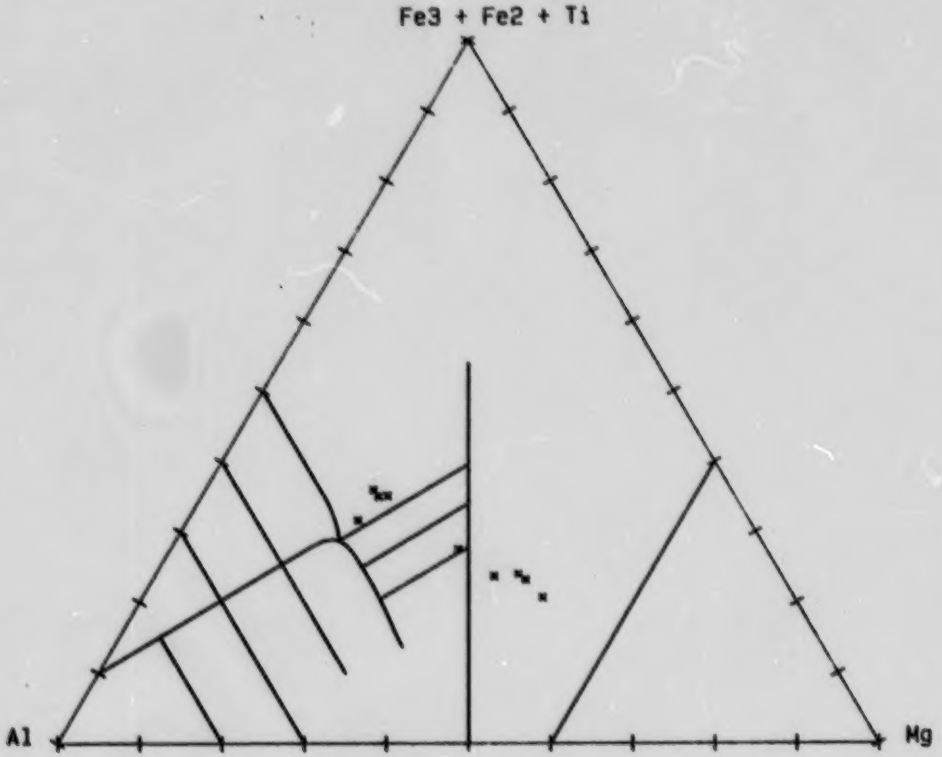
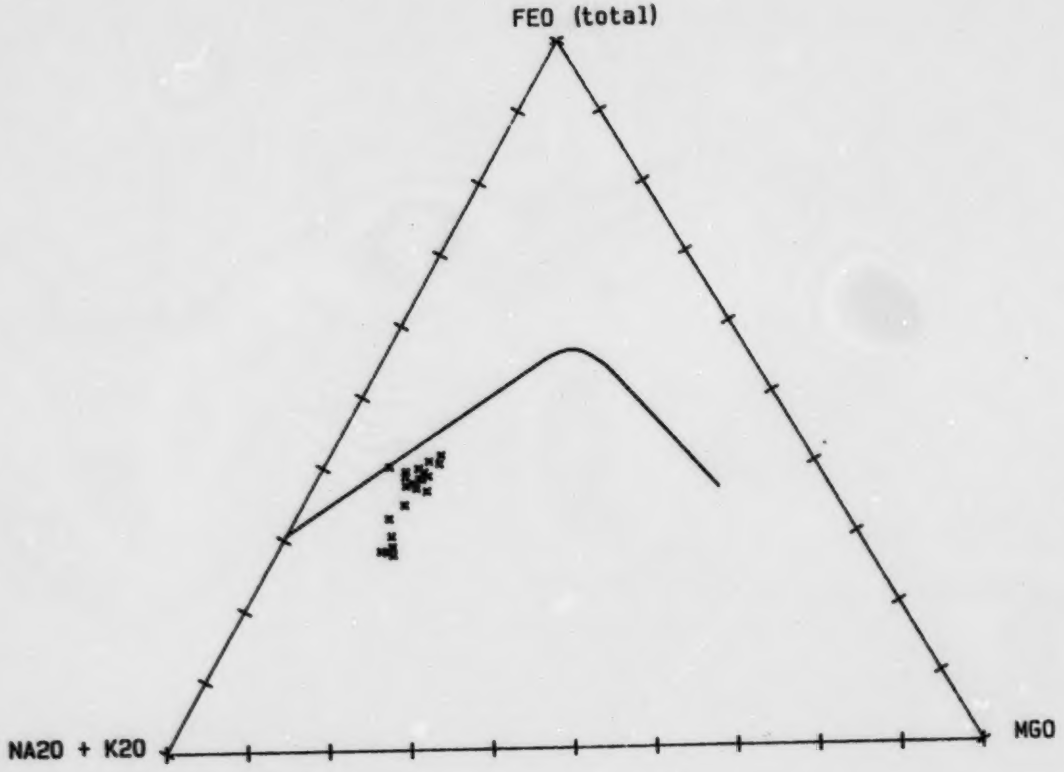


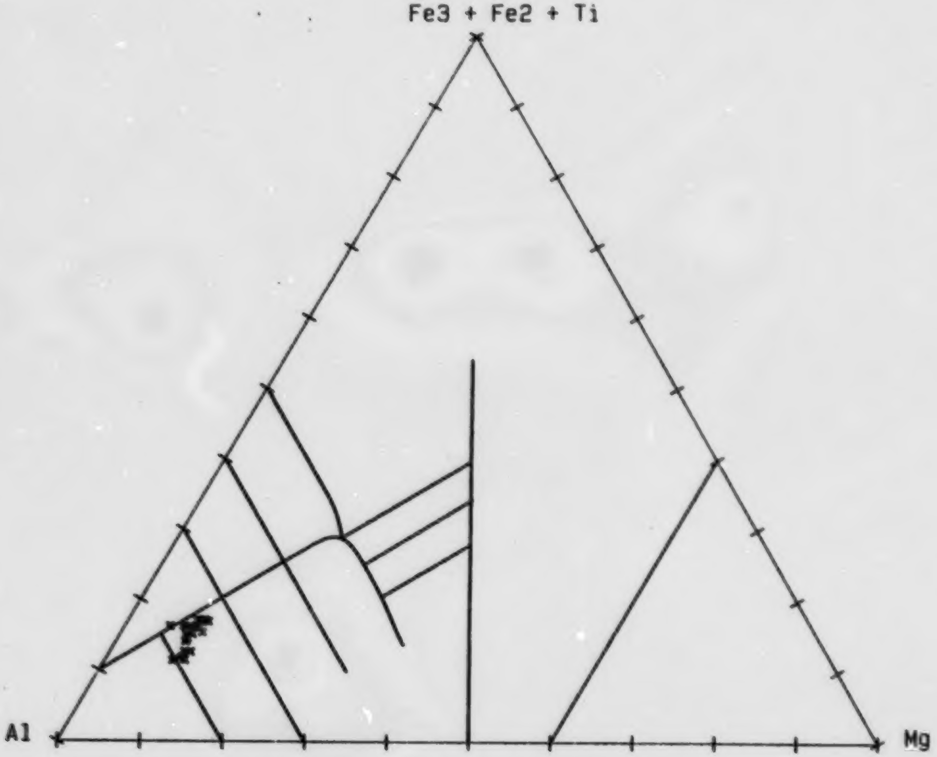
Fig. 12
FELSIC INTRUSIVE, GUTCHER LAKE STOCK AREA II



SAGE

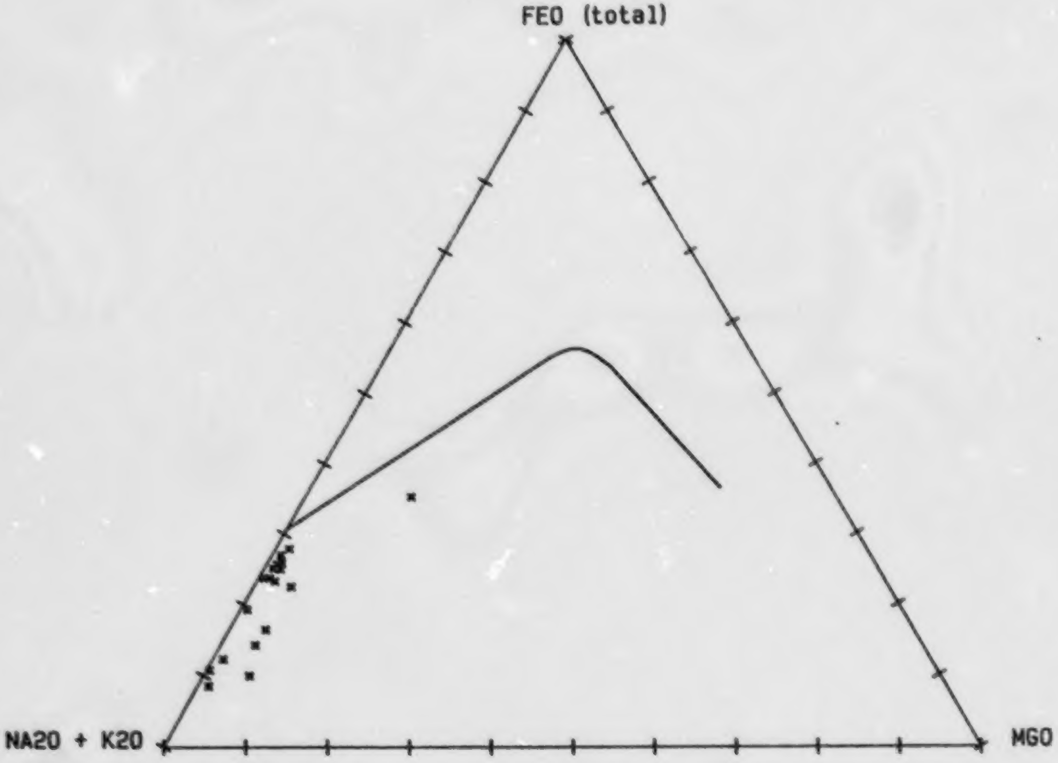
Fig. 13

FELSIC INTRUSIVE GUTCHER LAKE STOCK AREA II



SAGE

Fg. 14
FELSIC INTRUSIVE, MIDDLETON LAKE AREA II



SAGE

Fig. 15

FELSIC INTRUSIVE MIDDLETON LAKE AREA II

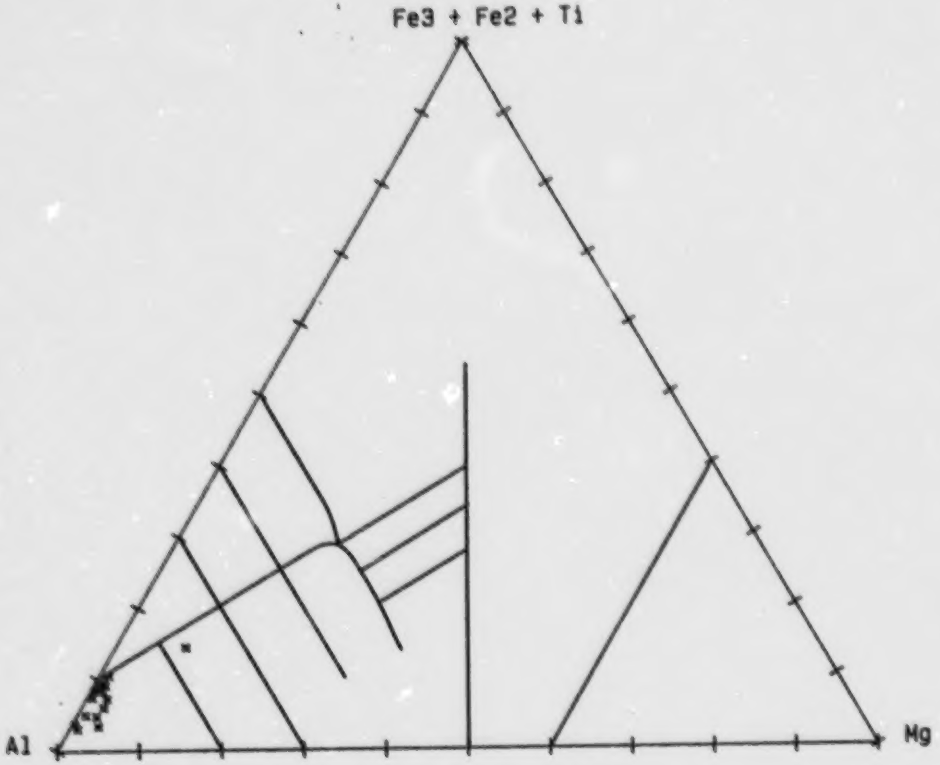


Fig. 16

FELSIC INTRUSIVE, LUND LAKE STOCK AREA II

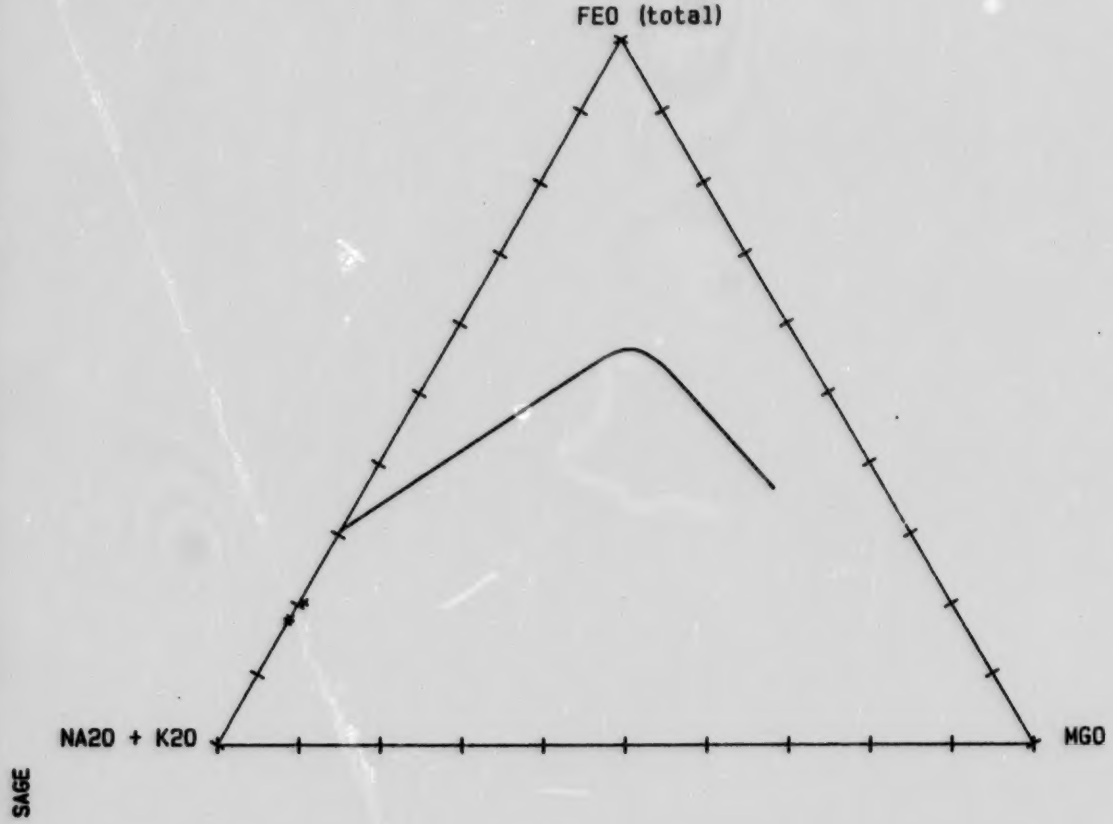
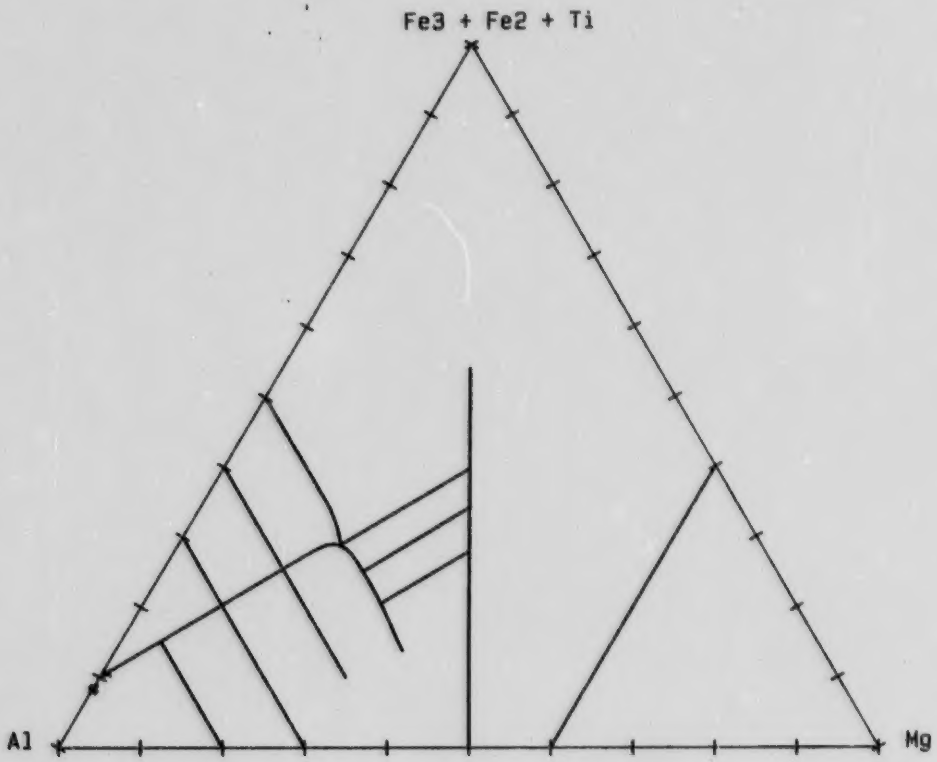


Fig. 17
FELSIC INTRUSIVE LUND LAKE STOCK AREA II


Fe3 + Fe2 + Ti
Al
Mg

SAGE

Fig. 18
AFM PLOT: TROUPE LAKE STOCK

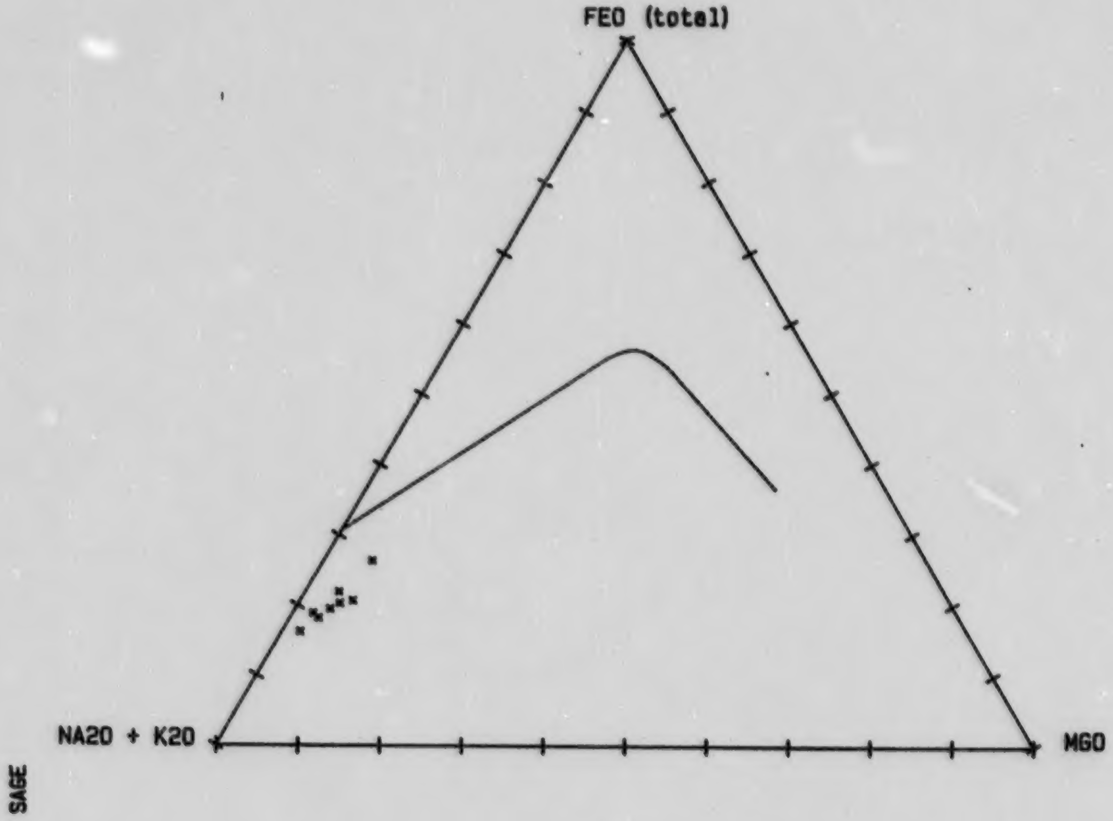


Fig. 19

JENSEN PLOT: TROUPE LAKE STOCK

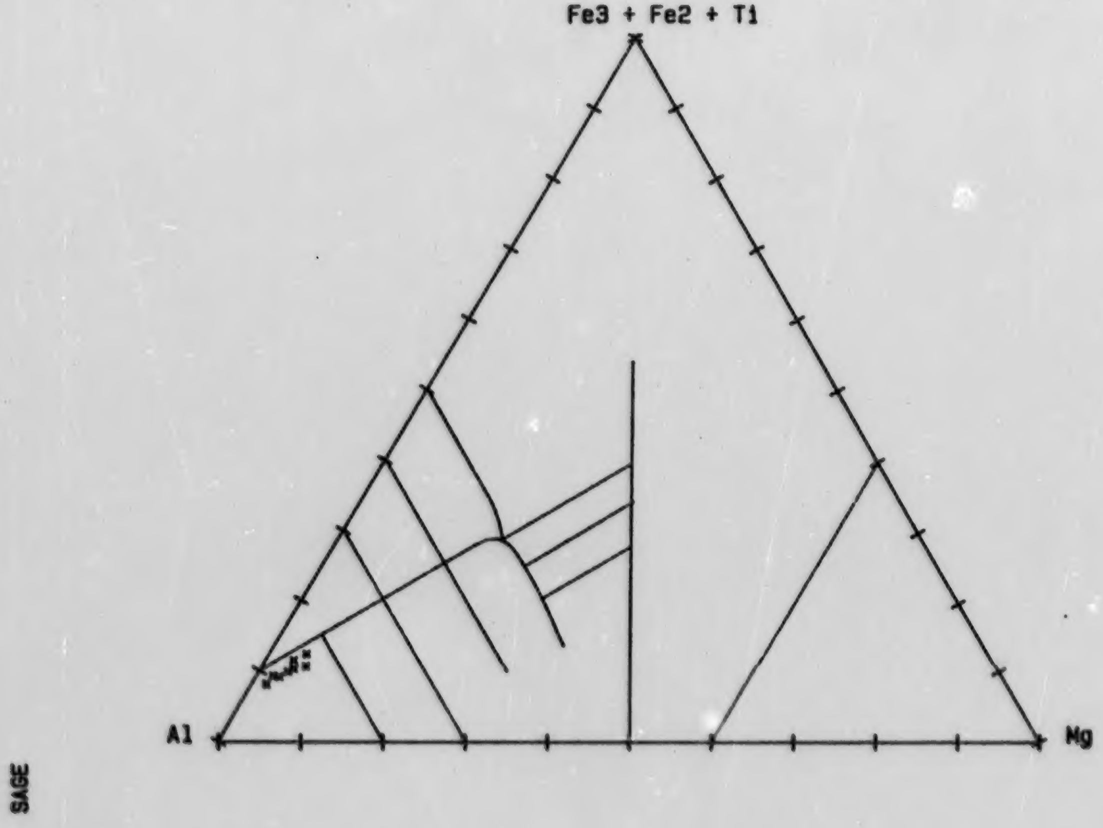


Fig. 20

ALTERATION CHLORITOID, FELSIC VOLCANICS AREA II

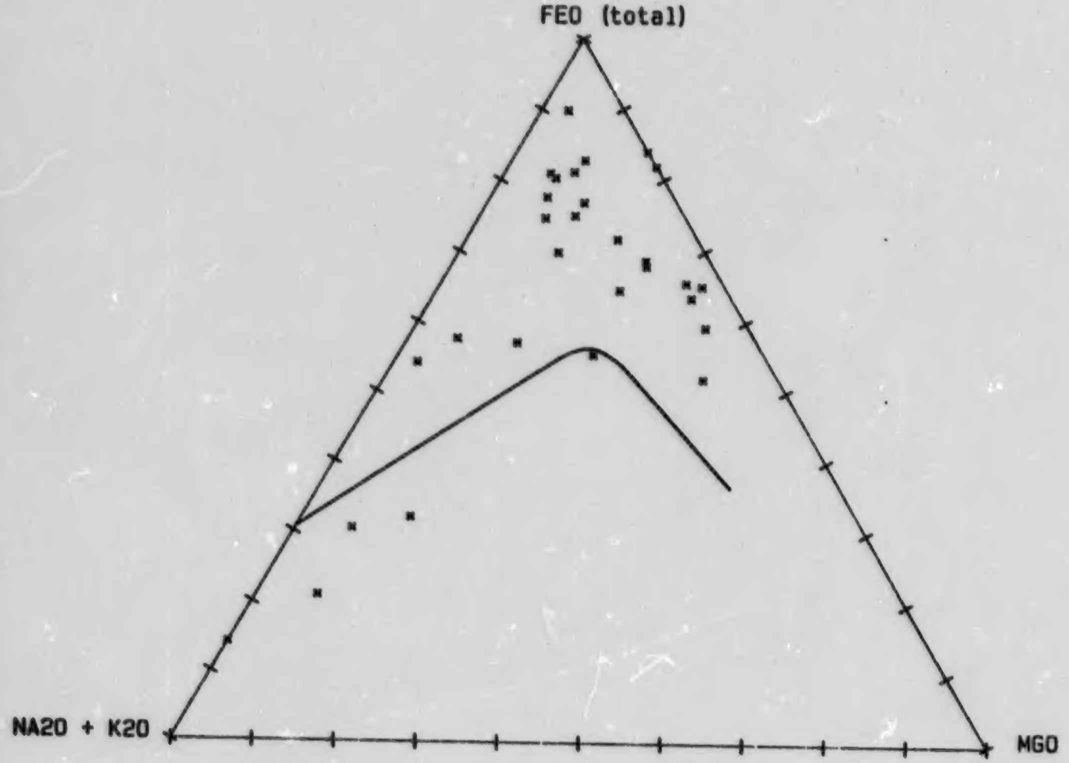
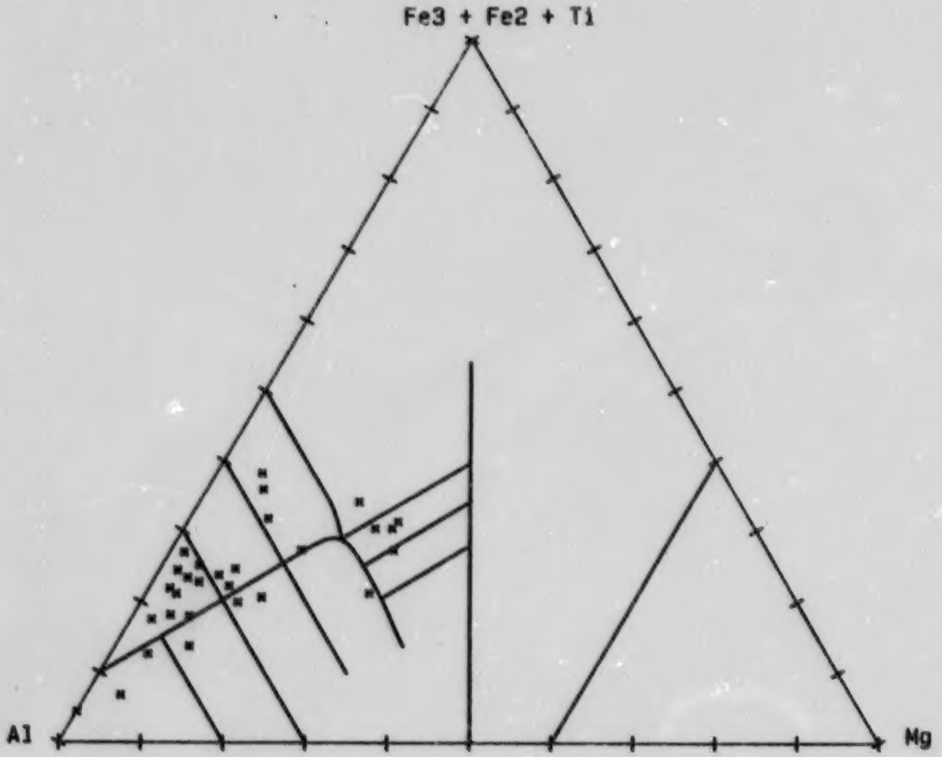


Fig. 21

ALTERATION CHLORITOID, FELSIC VOLCANICS AREA II



SAGE

Fig. 22
ALTERATION CHLORITOID, MAFIC VOLCANICS AREA II

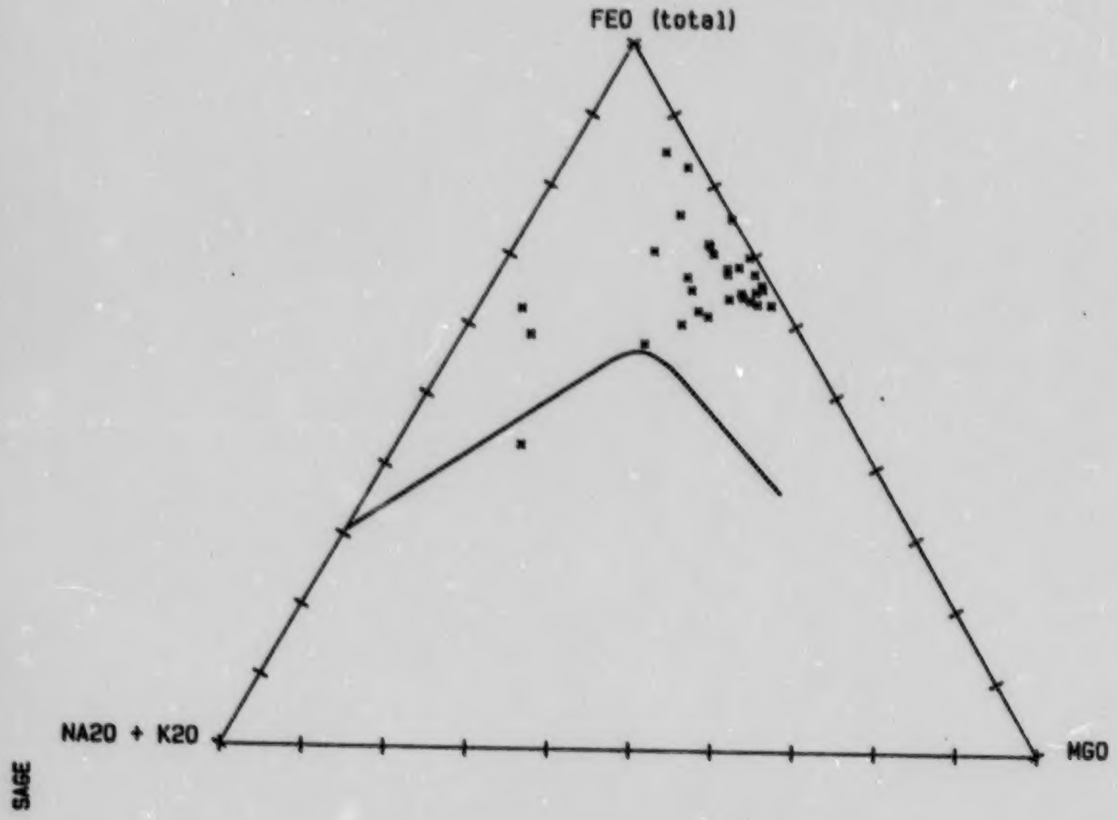
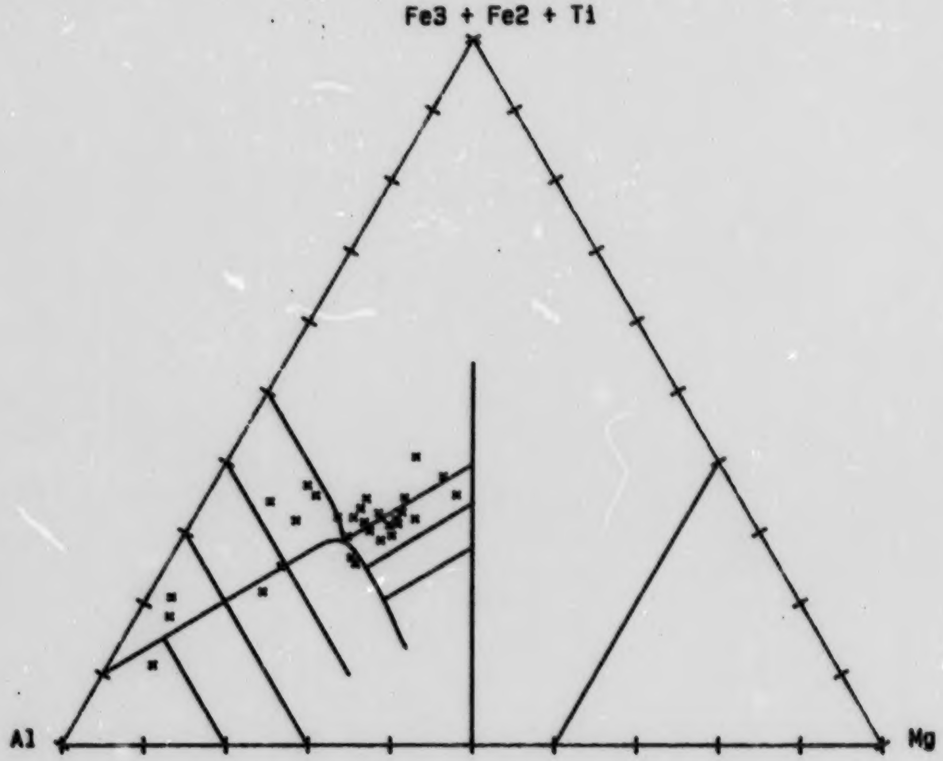


Fig. 23

ALTERATION CHLORITOID MAFIC VOLCANICS AREA II



SAGE

Fig. 24
ALTERATION MAFIC INTRUSIVES, AREA II

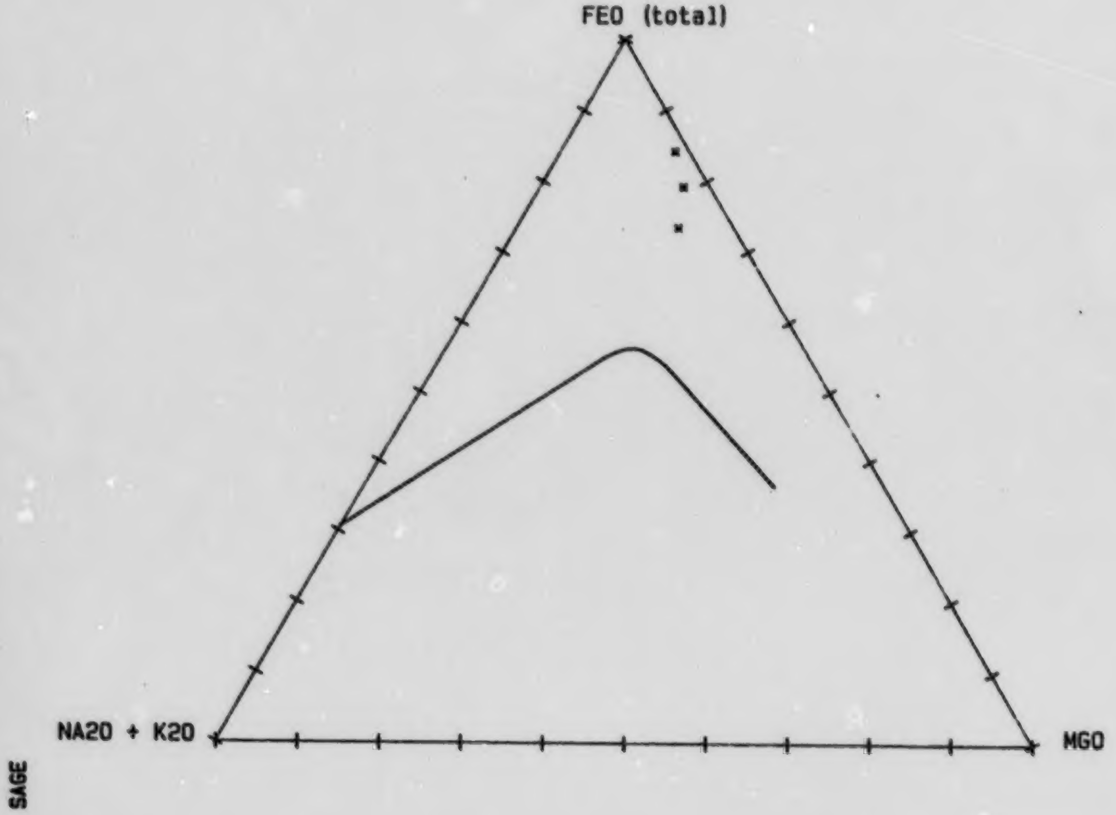
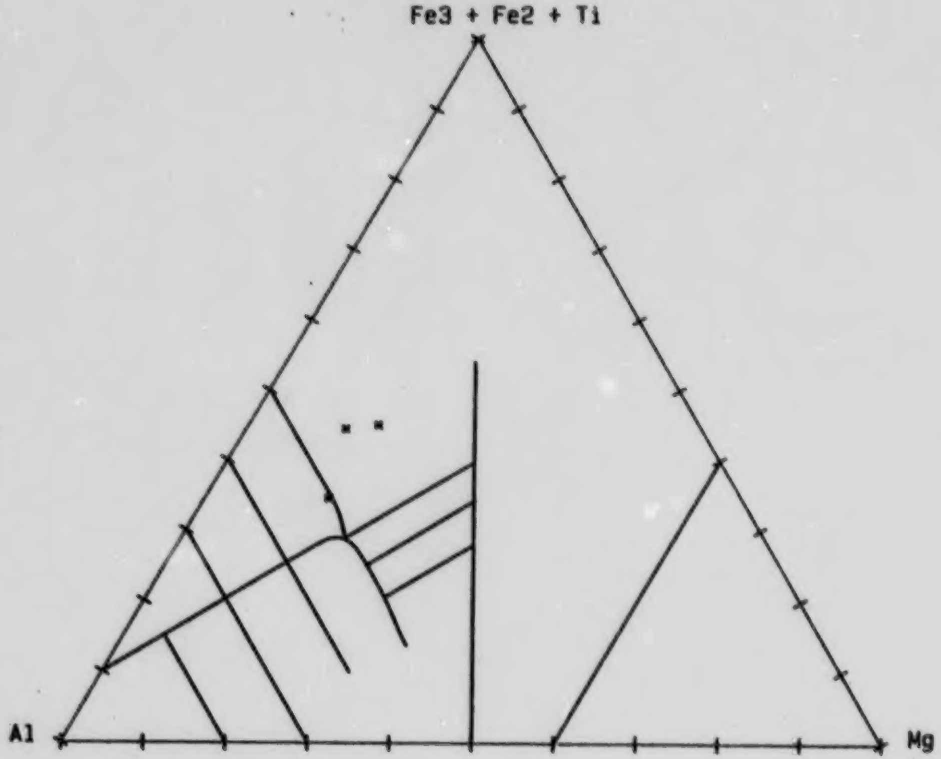


Fig. 25

ALTERATION MAFIC INTRUSIONS AREA II



SAGE

Fig. 26
ALTERATION TOURMALINE, MAFIC VOLCANICS AREA II

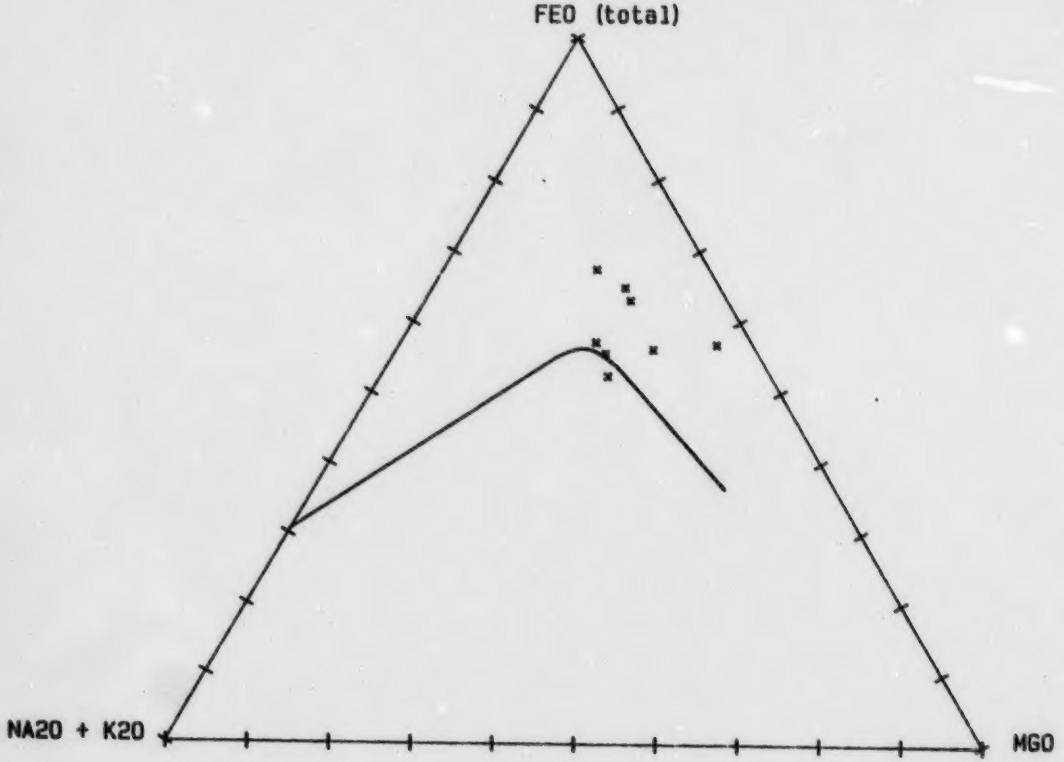
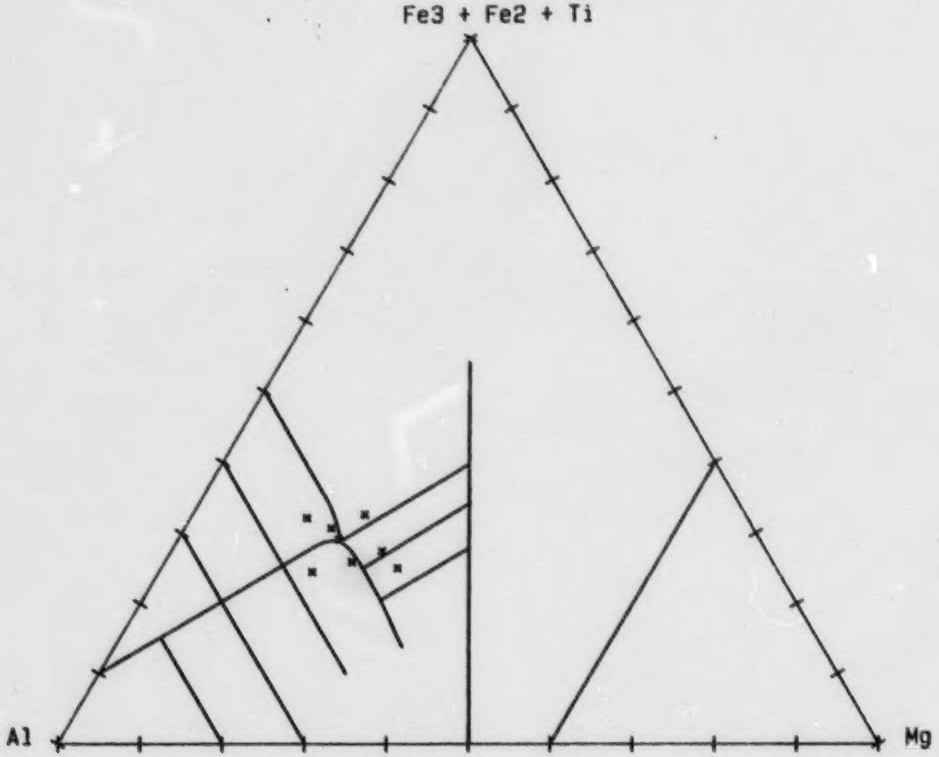


Fig. 27
ALTERATION TOURMALINE MAFIC VOLCANICS AREA II



SAGE

Fig 28
ALTERATION MAGPIE MINE POTASSIUM AREA II

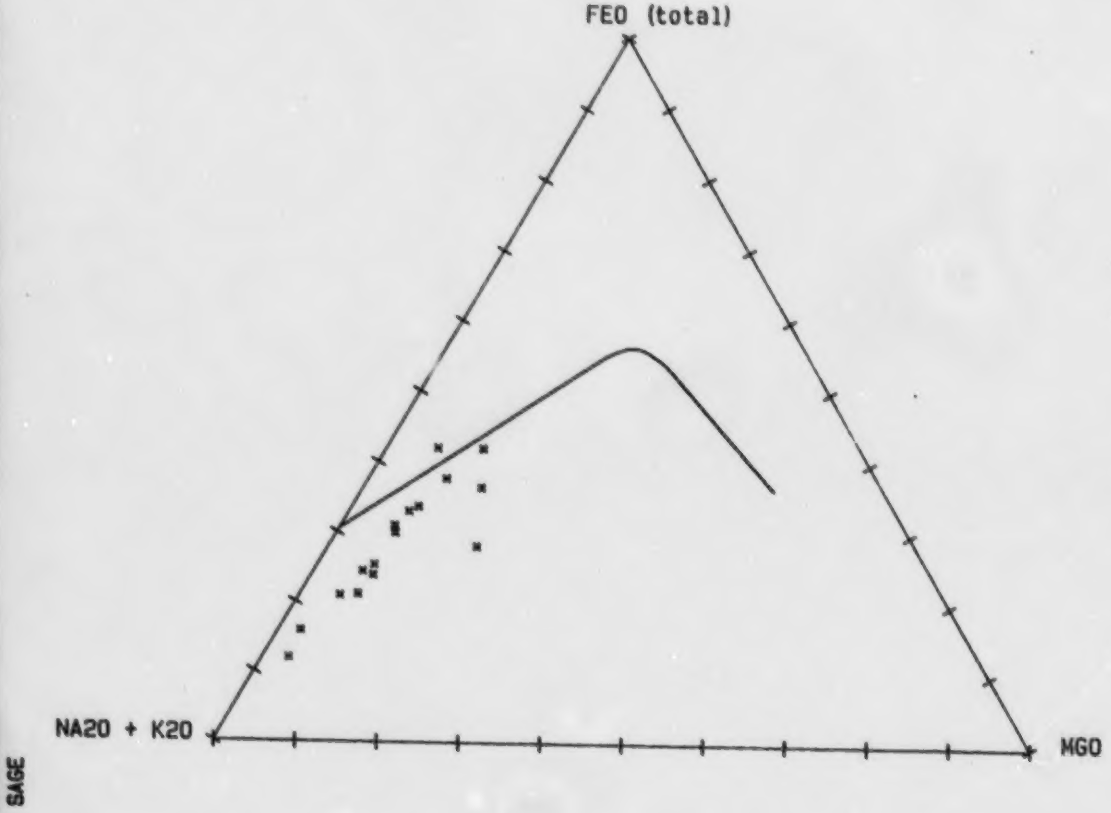
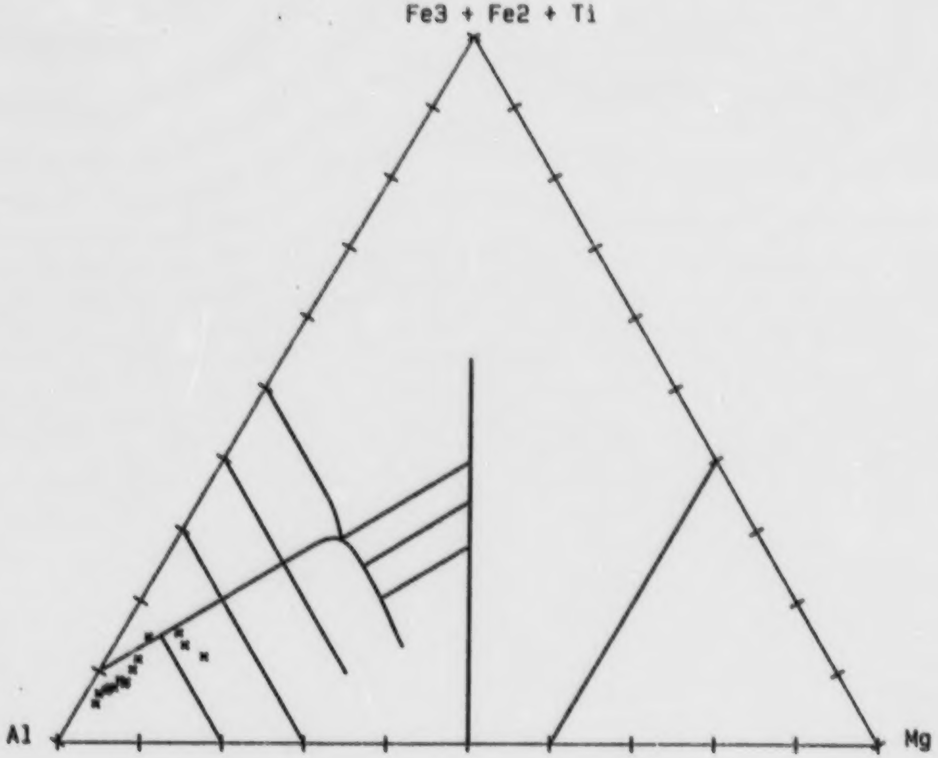


Fig. 29
ALTERATION MAGPIE MINE POTASSIUM AREA II



SAGE

Fig. 30
MAGPIE MINE VOLCANICS - GENERAL AREA II

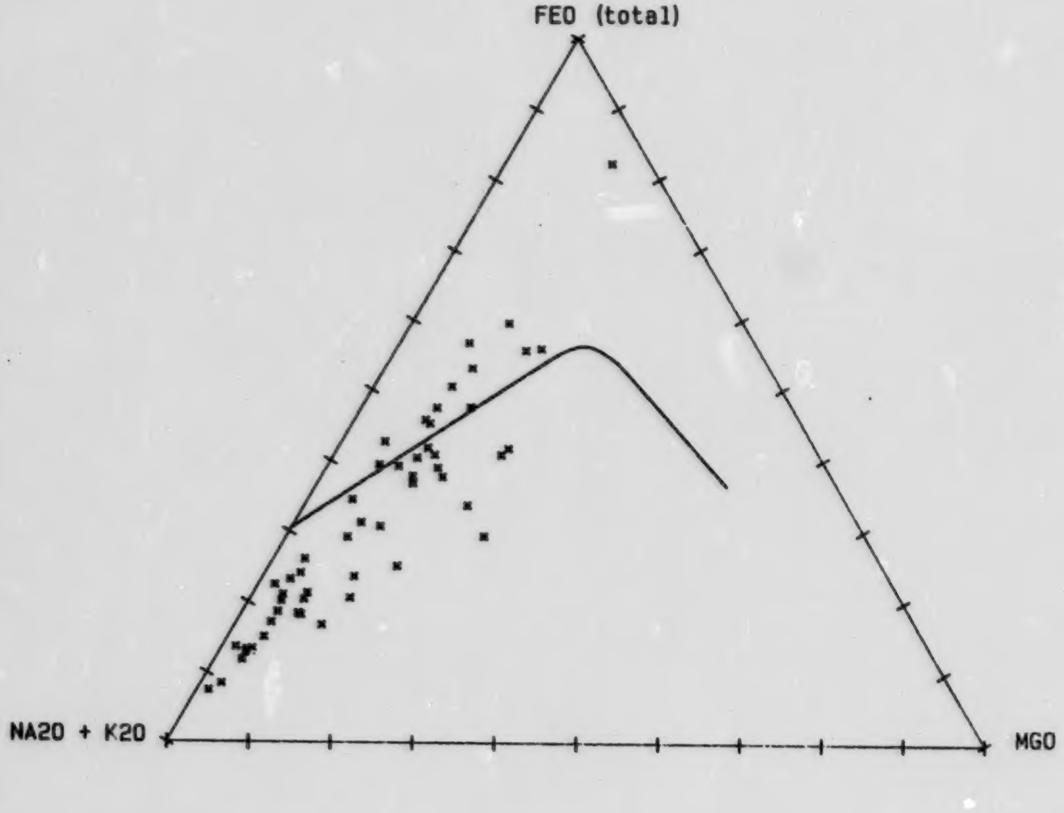


Fig. 31

MAGPIE MINE VOLÇANICS - GENERAL AREA II

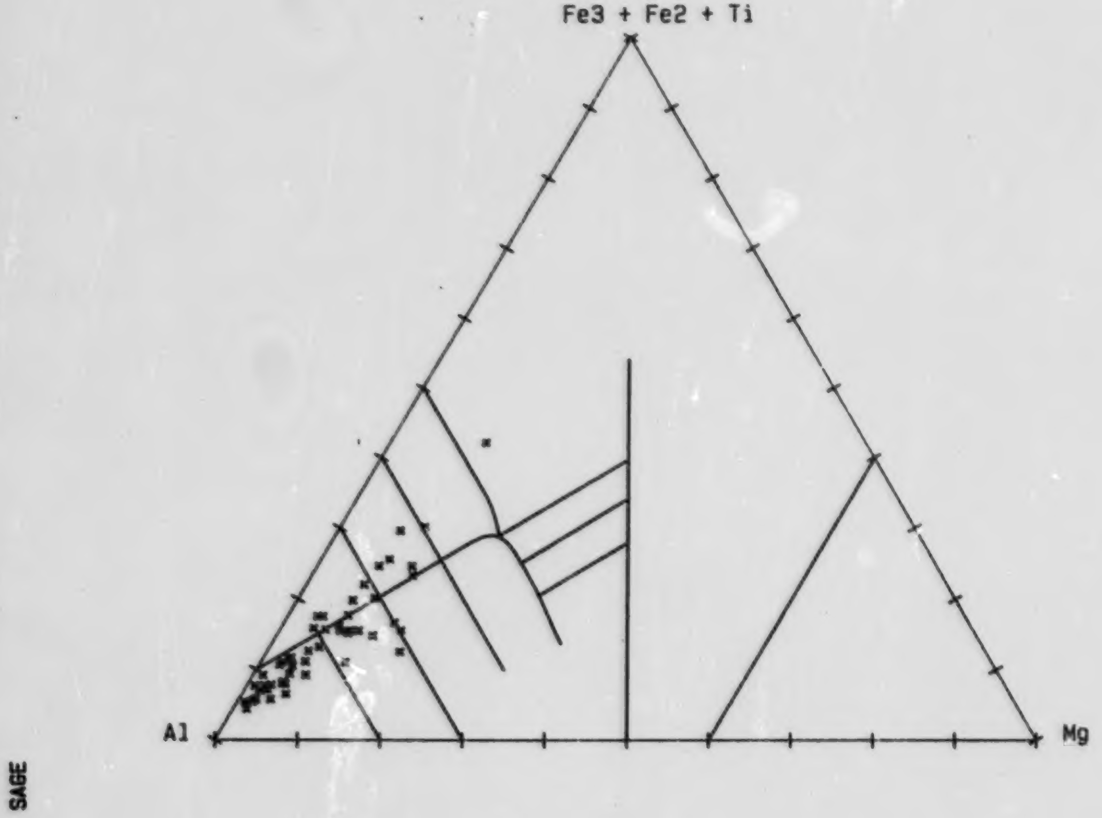
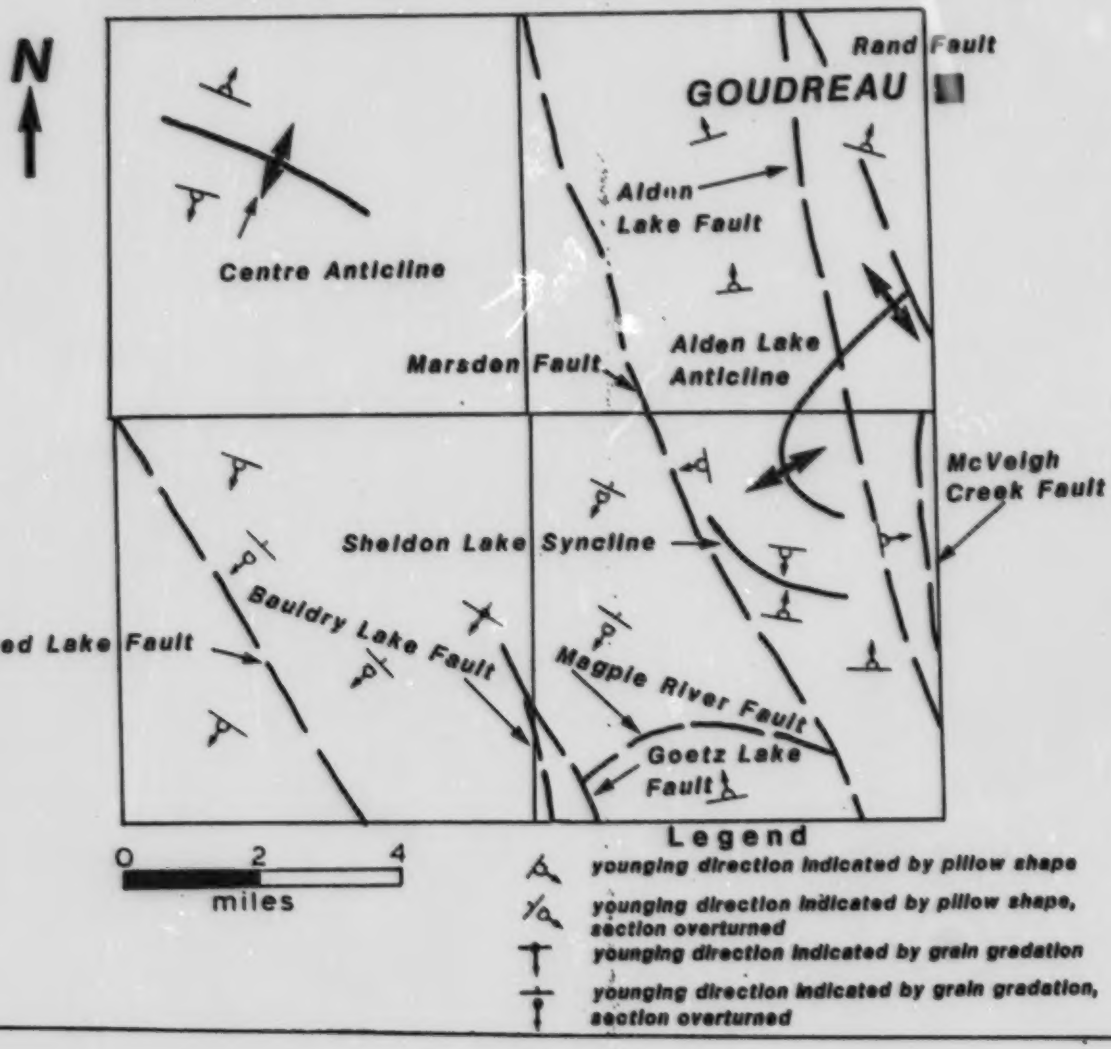
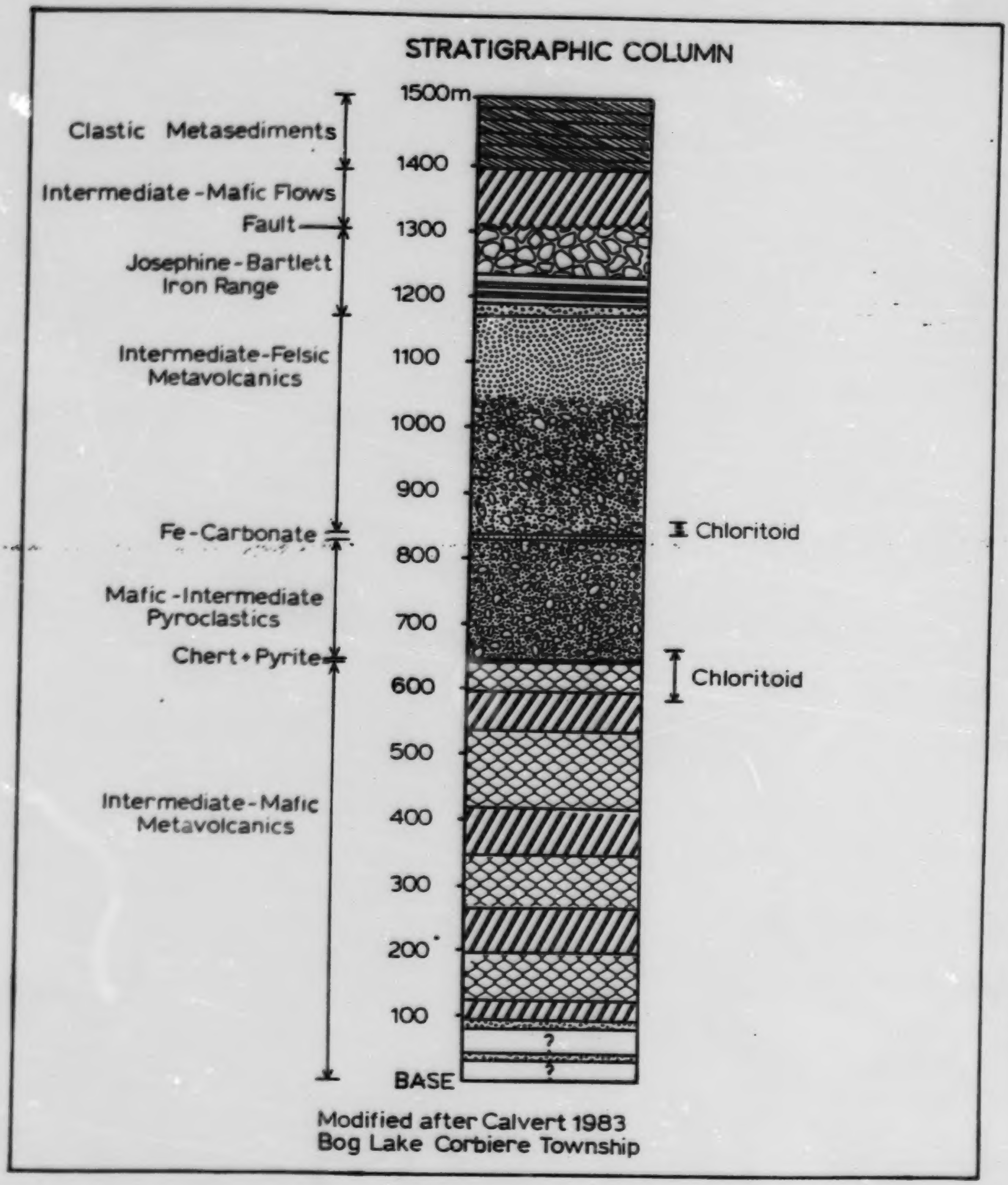


Fig. 32

Schematic diagram of major geologic structures.- Abotossaway, Corbiere, LeClaire and Musquash Townships


N
Rand Fault
GOUDREAU
Alden Lake Fault
Centre Anticline
Alden Lake Anticline
Marsden Fault
McVeigh Creek Fault
Sheldon Lake Syncline
Mildred Lake Fault
Bauldry Lake Fault
Magpie River Fault
Goetz Lake Fault
0
2
4
miles
Legend
younging direction indicated by pillow shape
younging direction indicated by pillow shape, section overturned
younging direction indicated by grain gradation
younging direction indicated by grain gradation, section overturned


STRATIGRAPHIC COLUMN
1500m
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
BASE
Clastic Metasediments
Intermediate - Mafic Flows
Fault
Josephine - Bartlett Iron Range
Intermediate - Felsic Metavolcanics
Fe - Carbonate
Mafic - Intermediate Pyroclastics
Chert + Pyrite
Intermediate - Mafic Metavolcanics
Chloritoid
Chloritoid
?
?

Modified after Calvert 1983
Bog Lake Corbiere Township

Fig. 33

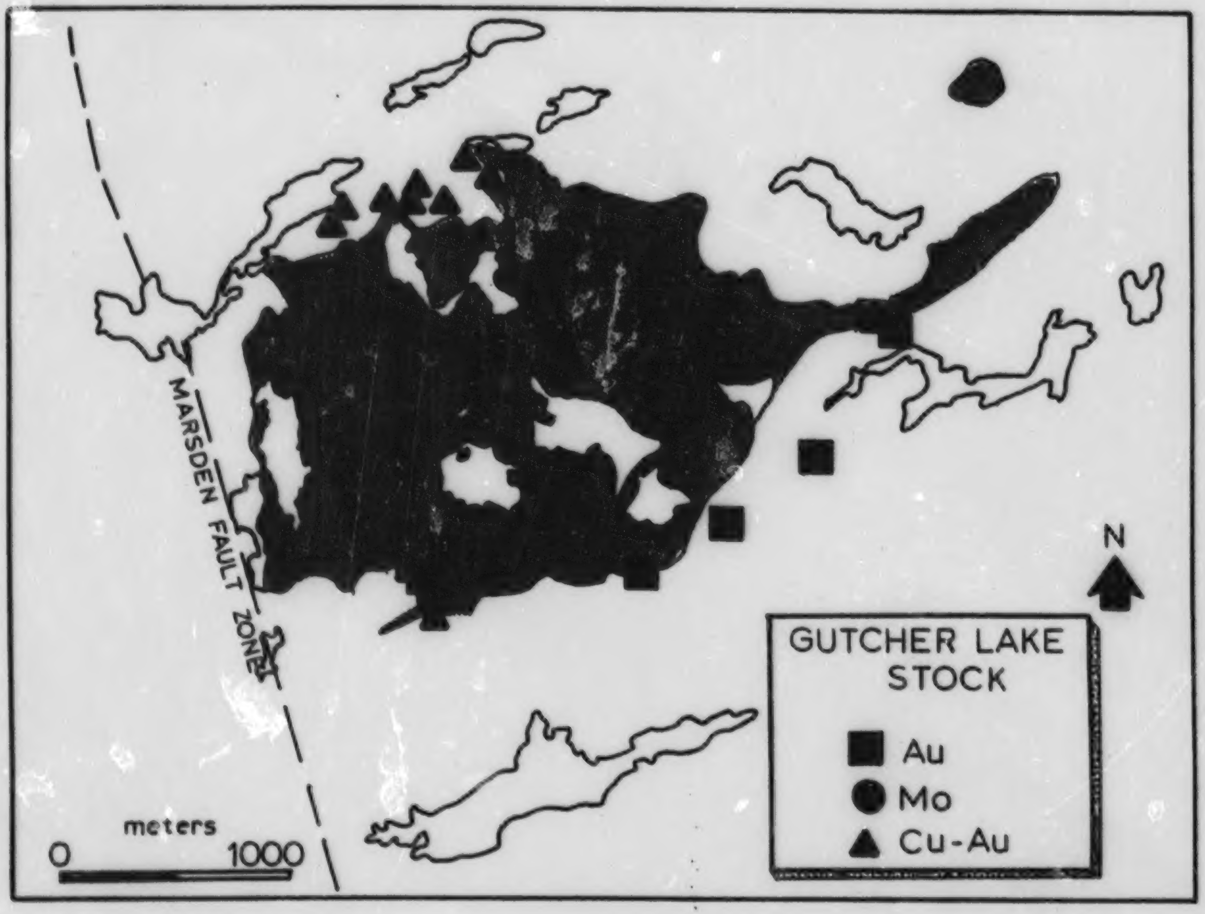

MARSDEN FAULT ZONE
GUTCHER LAKE STOCK
■ Au
● Mo
▲ Cu-Au
N
meters
0
1000

Fig. 34

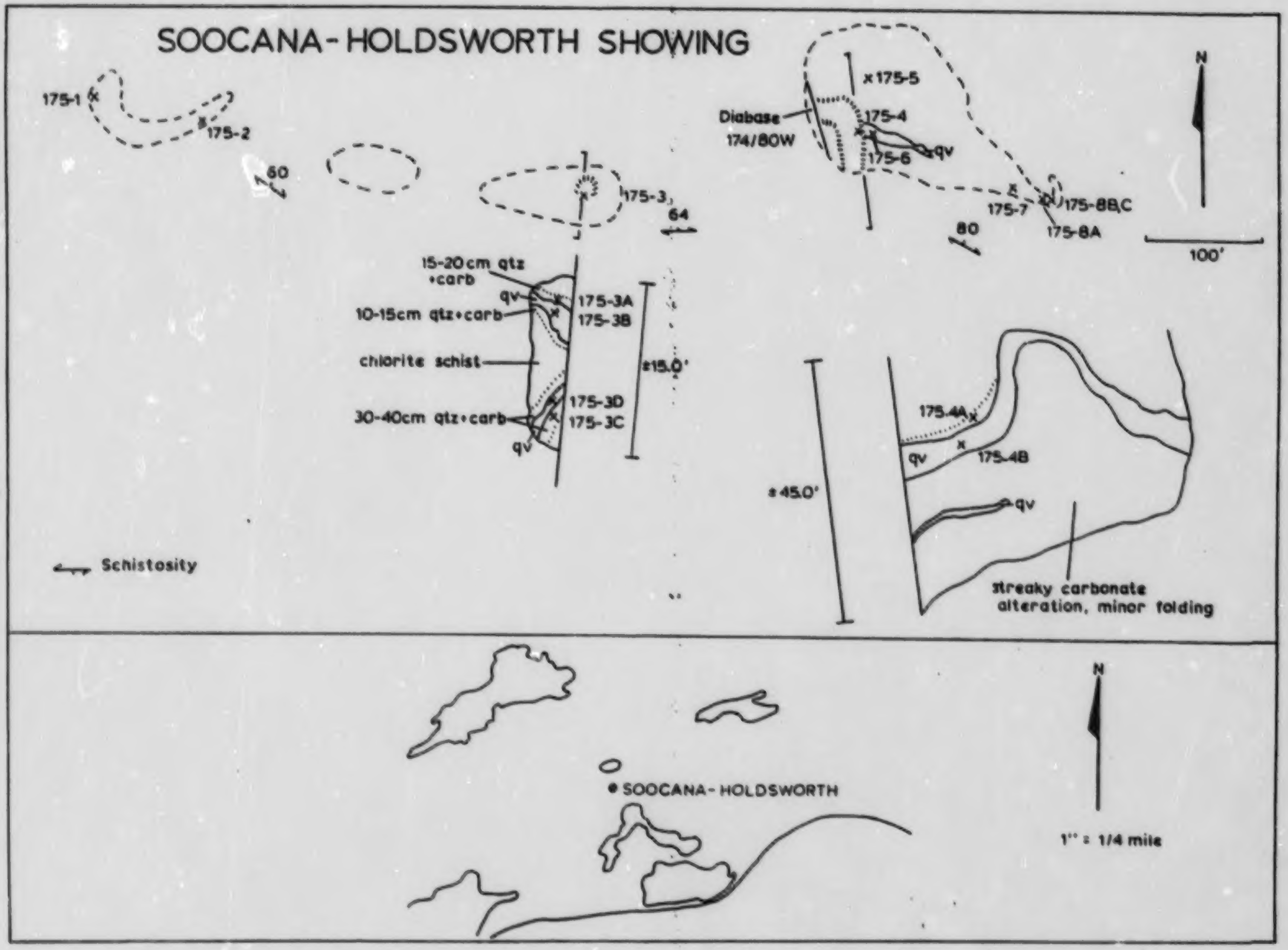

SOOCANA-HOLDSWORTH SHOWING
175-1
175-2
60
175-3
64
Diabase
174/80W
x 175-5
175-4
175-6
qv
175-7
175-8B,C
175-8A
80
N
100'
15-20cm qtz +carb
qv
10-15cm qtz+carb
chlorite schist
30-40cm qtz+carb
qv
175-3A
175-3B
175-3D
175-3C
±15.0'
±45.0'
175-4A
qv
175-4B
qv
streaky carbonate alteration, minor folding
Schistosity
SOOCANA-HOLDSWORTH
N
1" = 1/4 mile

Fig. 52

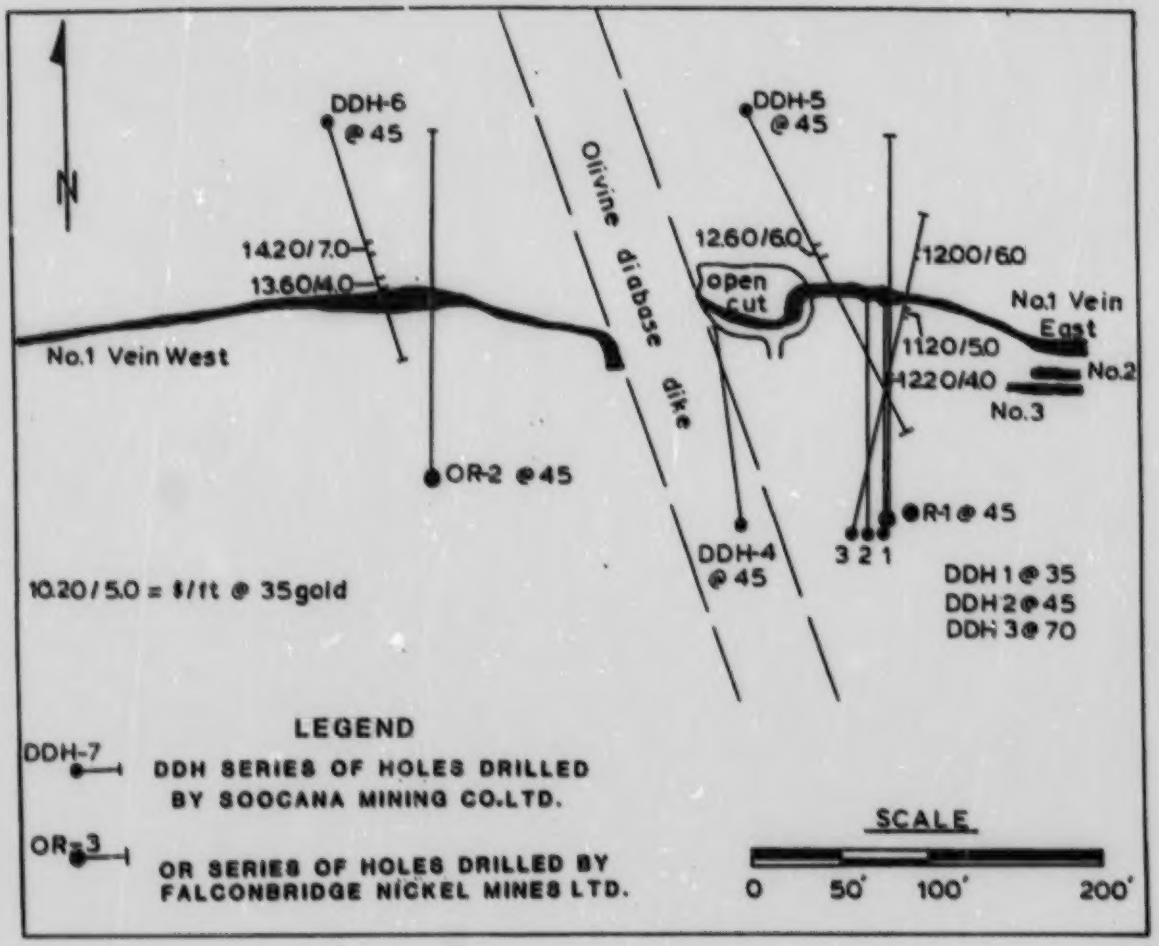

N
DDH-6
@ 45
1420/7.0
1360/4.0
No.1 Vein West
OR-2 @ 45
Olivine diabase dike
DDH-5
@ 45
1260/6.0
open cut
1200/6.0
No.1 Vein
East
No.2
1120/5.0
1220/4.0
No.3
DDH-4
@ 45
R-1 @ 45
3 2 1
DDH 1 @ 35
DDH 2 @ 45
DDH 3 @ 70
10.20 / 5.0 = $/ft @ 35 gold
LEGEND
DDH-7
DDH SERIES OF HOLES DRILLED BY SOOCANA MINING CO.LTD.
OR-3
OR SERIES OF HOLES DRILLED BY FALCONBRIDGE NICKEL MINES LTD.
SCALE
0
50'
100'
200'

Fig. 53

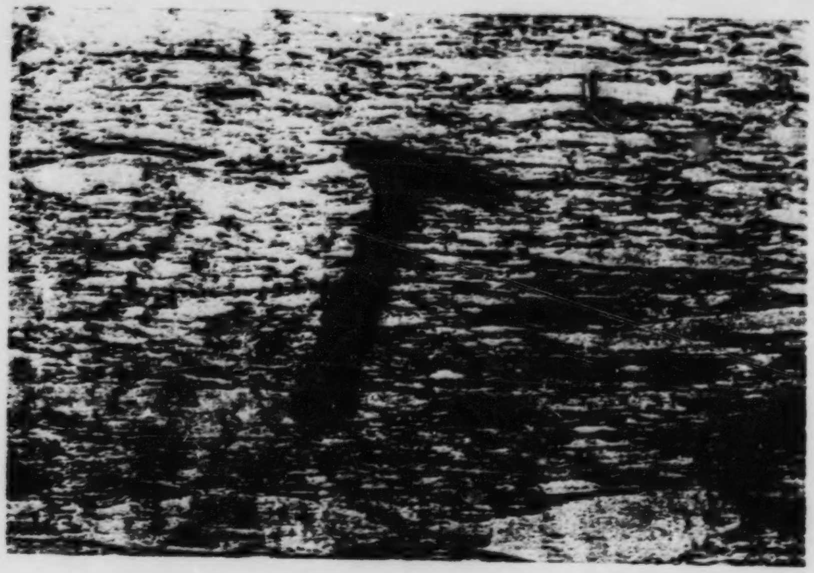


Photo 1 Highly stretched intermediate to felsic breccia with occasional mafic clast. Outcrop exposed at Cedar Falls on the Magpie River, Leclaire Township (Location P-1).

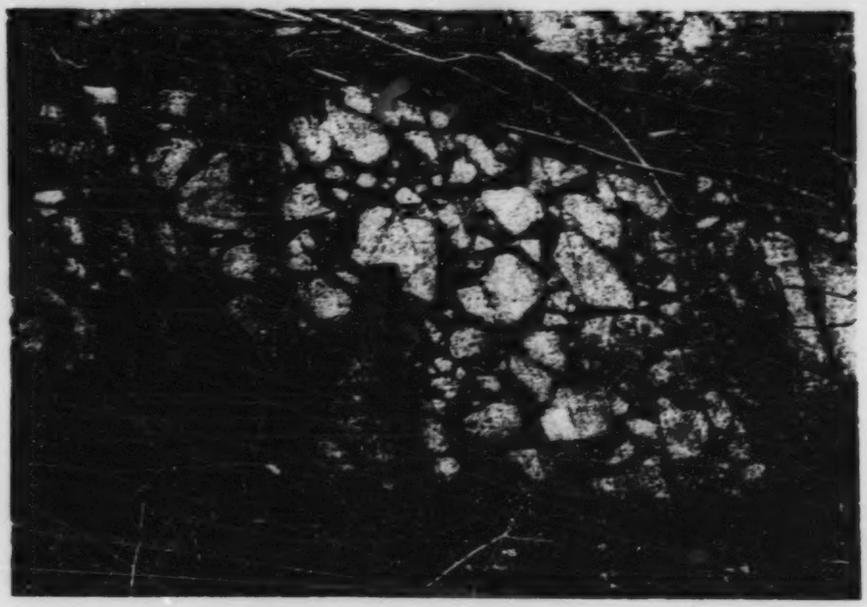


Photo 2 Rounded to very angular intermediate to felsic clasts in a chlorite-rich matrix. Breccia occurs on the west side of the Alice Lake Iron Range, Leclaire Township (Location P-2).

Photo 3 Intermediate to felsic lapilli tuff in the Reau-Mary Lakes area, Corbiere Township (Location P-3).

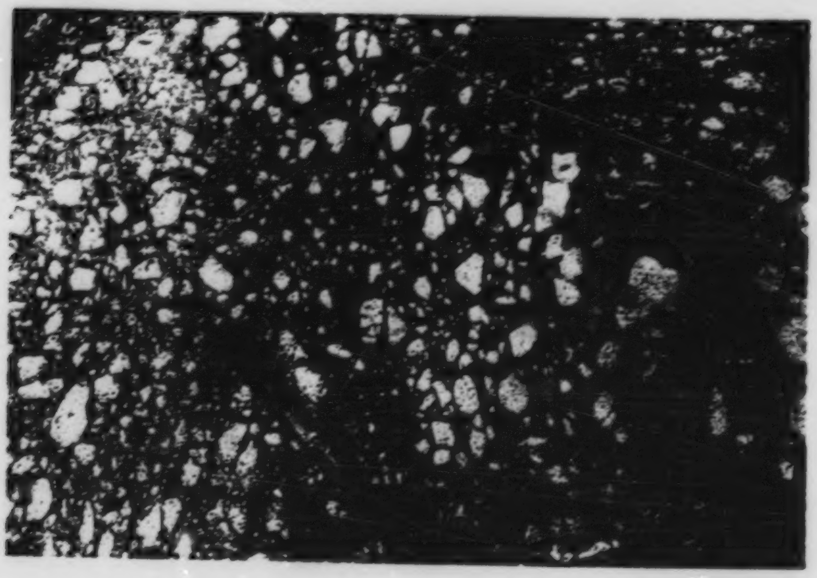


Photo 4 Intermediate to felsic breccia with chlorite-rich matrix. Reau-Mary Lakes area, Corbiere Township (Location P-3).

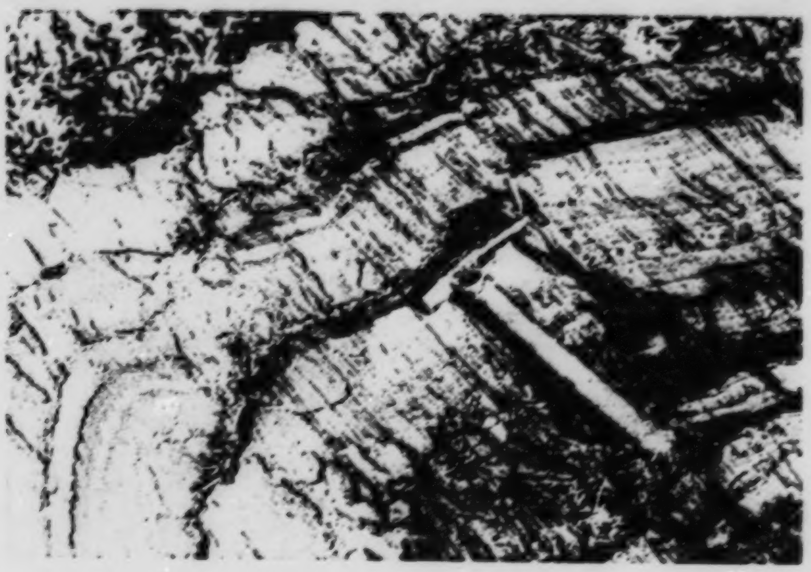


Photo 5 Thin bedded metasedimentary rock complexly folded and displaying a prominent axial planar cleavage. West Andre Lake, Musquash Township (Location P-5).

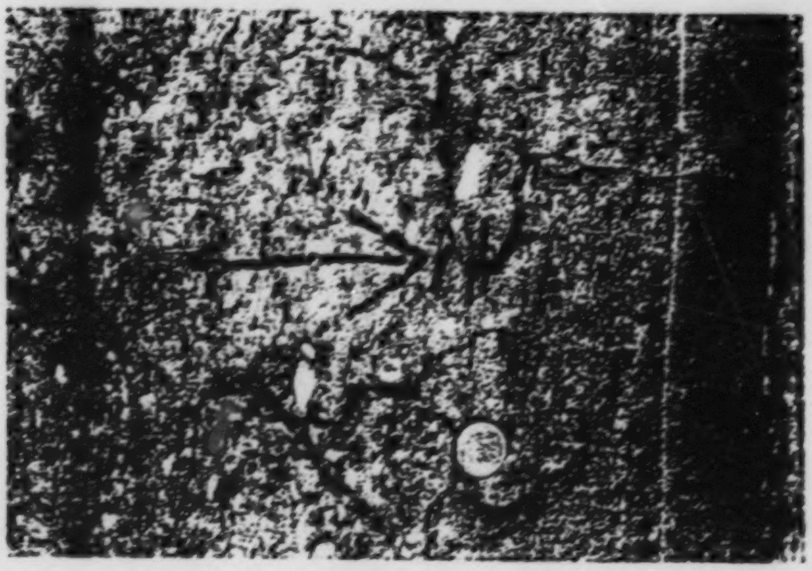


Photo 6 Graded bedding within metasedimentary rocks consisting dominantly of intermediate to felsic metavolcanic rock, West Andre Lake, Musquash Township (Location P-6).

Photo 7 Dore-type conglomerate, Dunphy Township. Granite cobbles and boulders in Wacke matrix (Location P-10).

Photo 8 Porphyritic texture in Troup Lake Stock, Dunphy Township (Location P-11).

Photo 9 Tourmaline along pillow selvages and within crosscutting fractures, southeast corner of Musquash Township (Location P-7).

Photo 10 Tourmaline crystals along fracture surface, southeast corner of Musquash Township (Location P-7).

Photo 11 Serrated margin of feldspar porphyry dike cutting amygdaloidal pillowed intermediate to mafic metavolcanic rocks east of Mall Lake, Abotossaway Township (Location P-8).

Photo 12 Headframe above shaft on Kozak Property in 1982, Abotossaway Township.

Photo 13 Rusty weathered mineralized fractures as they appear in a trench immediately south of shaft on Kozak Property, Abotossaway Township.

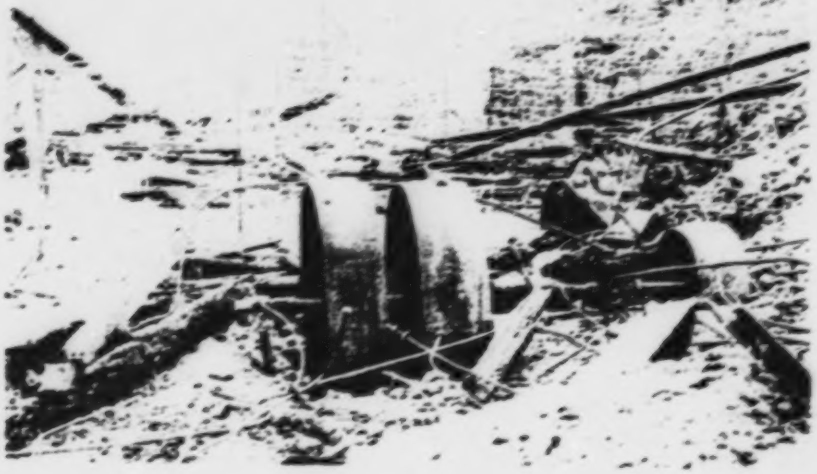


Photo 14 Rotting and rusting equipment at the Murphy Mine site. Photograph taken in summer of 1985.

Photo 15 Rotting remains of a mill at the west end of Edwards Lake (local name). Photograph taken in 1982 at the Edwards gold occurrence.

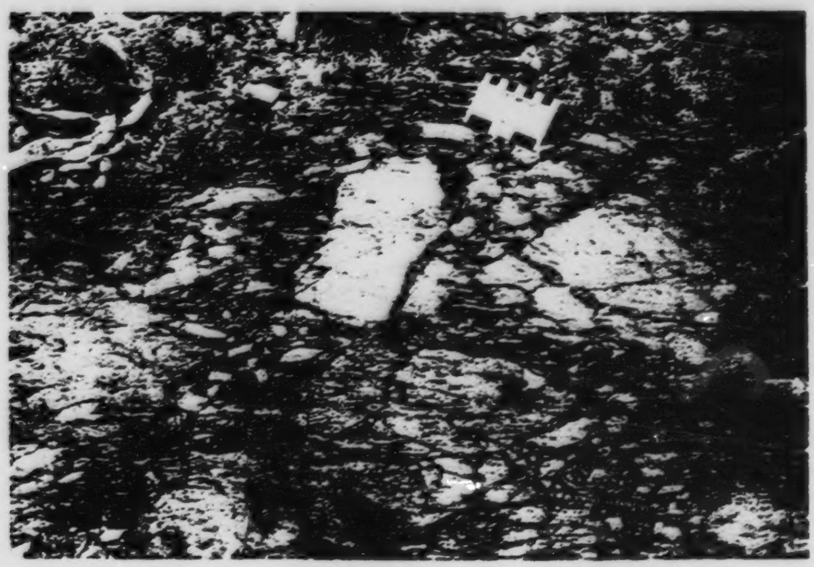


Photo 16 Crosscutting phreatic explosion breccia cutting intermediate to felsic metavolcanic rocks of the footwall to the Josephine Iron Range, Corbiere Township (Location P-9).

Photo 17a Josephine Mine as it appeared in 1946 before closing. Photograph by A. Gallie, Sherritt Gordon Mines Limited.

Photo 17b Josephine Mine site in 1982.

Photo 17c Collaring of the main Josephine Mine production shaft in approximately 1942, Photograph by A. Gallie.

Photo 17d Headframe of Josephine Mine as it appeared during shaft sinking (ca.1942). (Photograph courtesy of the Wawa Chamber of Commerce

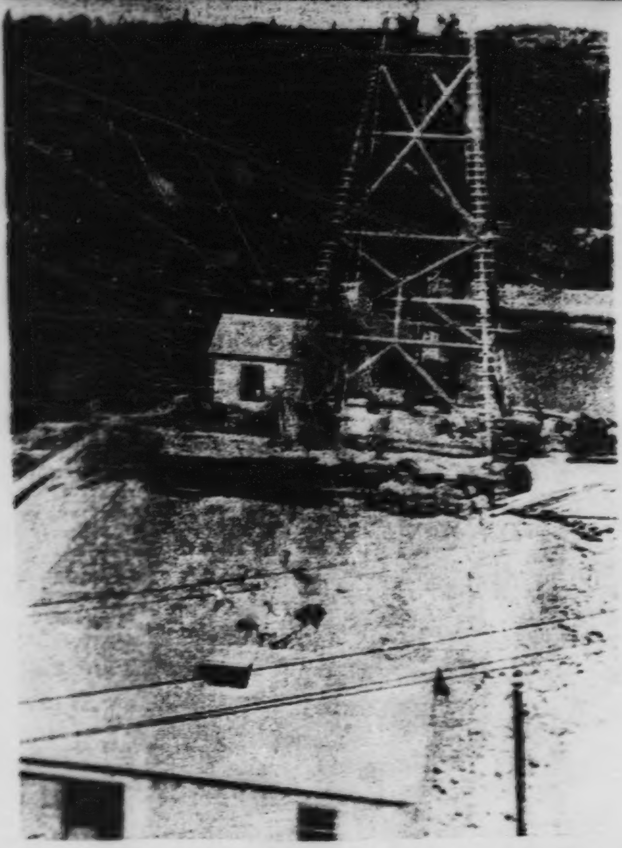


Photo 17e Josephine Mine headframe during shaft sinking ca.1941. Parks Lake in background is being drained. Photograph looking west across Parks Lake. Photograph by A. Gallie.

Photo 17f Loading facilities on railroad siding at Josephine Mine. Photograph by A. Gallie.

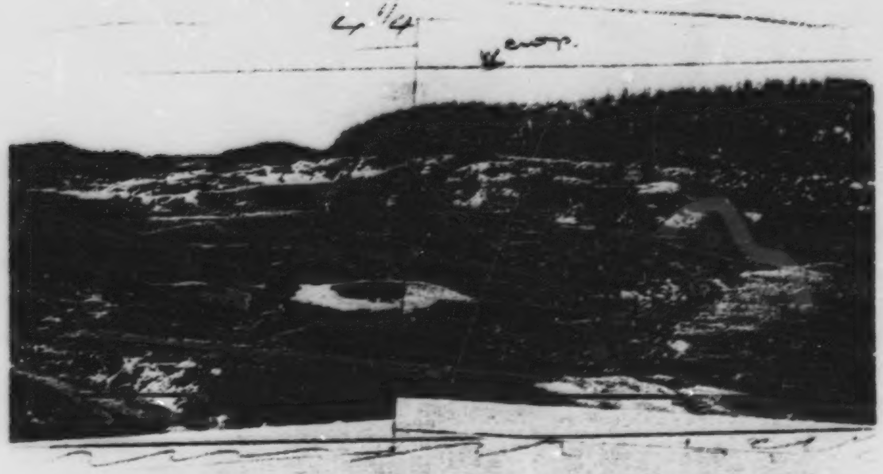


Figure 14.
Depression, looking west October 16th '46.

Photo 17g Composite photograph of caving ground in former lake bed o
Parks Lake. Photographs taken on October 16, 1946 by A. Gallie.

Photo 18 Rusting remains of a diamond drill, Soocana-Holdsworth Property, 1982.

Photo 19a Rotting remains of Mckinnon railroad trestle across the Magpie River south of the Magpie Mine. Photograph taken in 1982.

Photo 19b Power house at Steephill falls which supplied power to the Magpie Mine (Sutherland 1914).

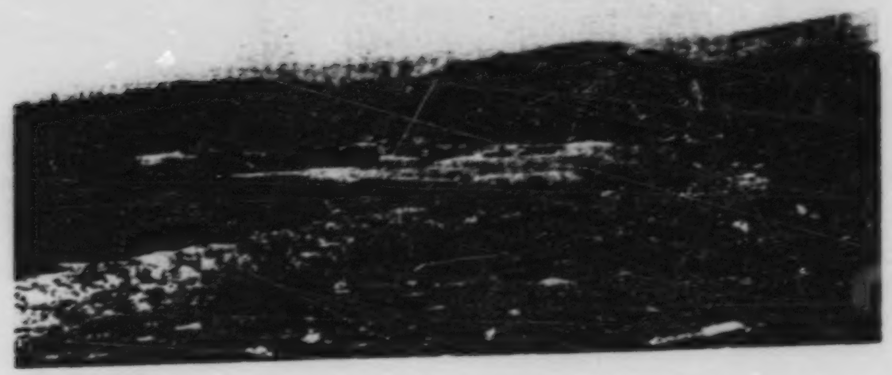


Photo 19c Collaring of main production shaft at the Magpie Mine (Corkill 1911).

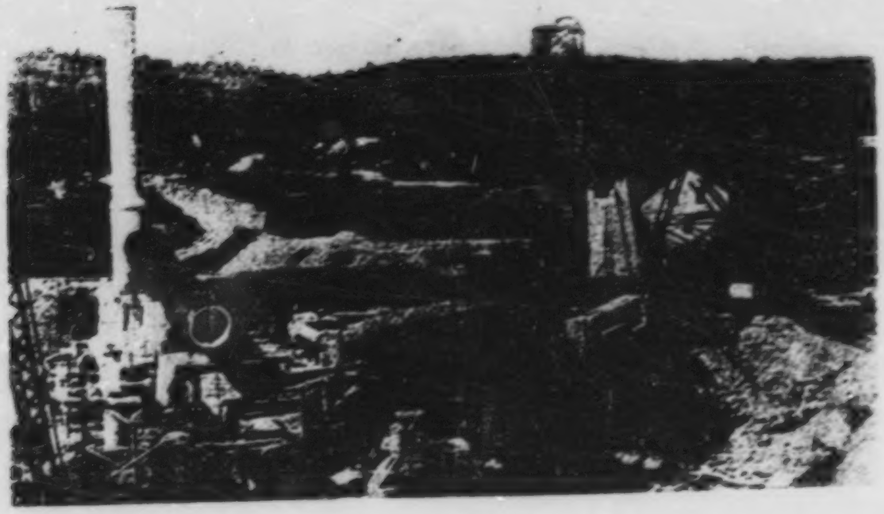


Photo 19d Constructing surface facilities and roasting plant at th Magpie Mine (Corkill 1913).

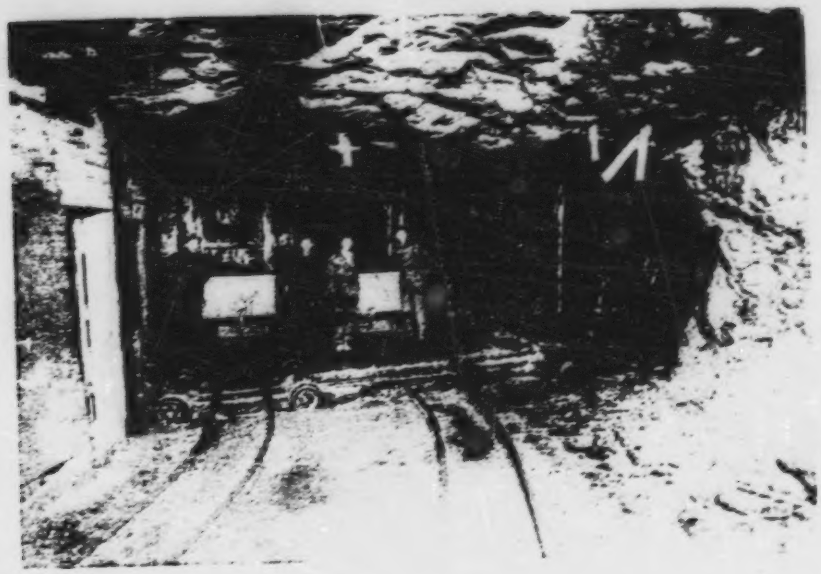


Photo 19e Underground at the Magpie Mine circ. 1917 (Annual report of the Algoma Steel Corporation, 1918).

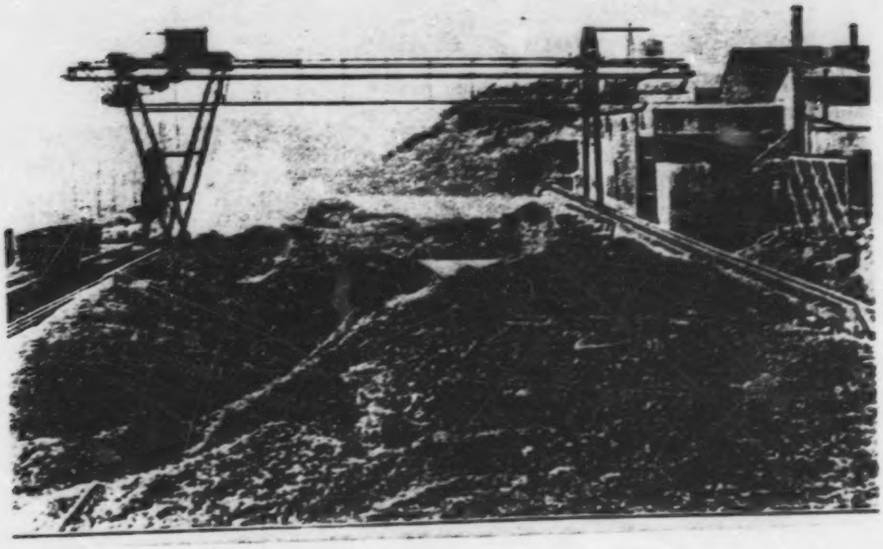


Photo 19f Storage area for sinter and the ore bridge looking east at the Magpie Mine. (Lindman and Bolton 1917).

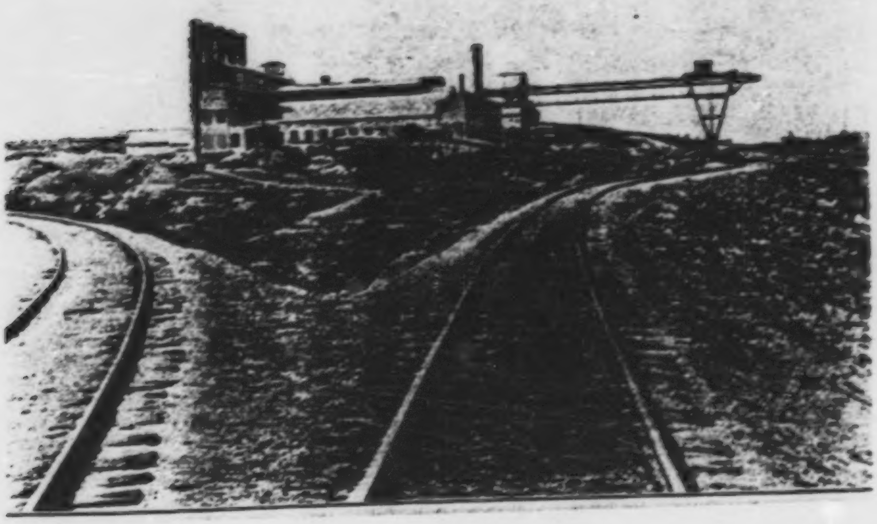


Photo 19g Magpie Mine surface plant looking west and along railroad tracks (Lindman and Bolton 1917).

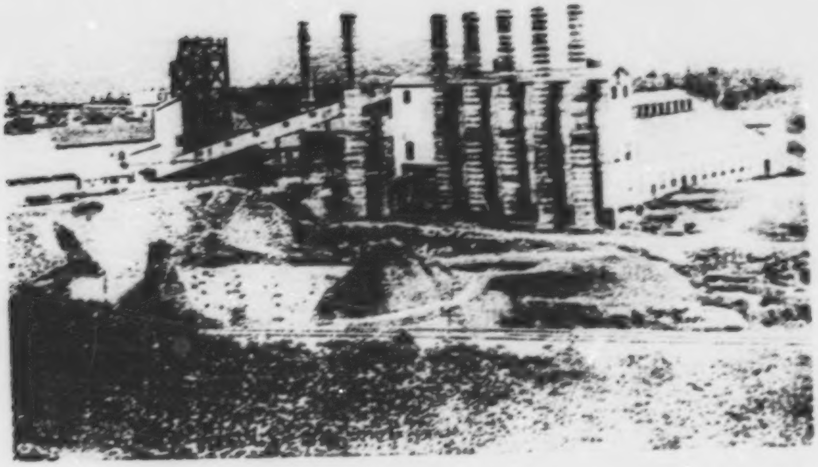


Photo 19h Surface plant of Magpie Mine looking northwest circ. 1917 (Annual report of the Algoma Steel Corporation, 1918).

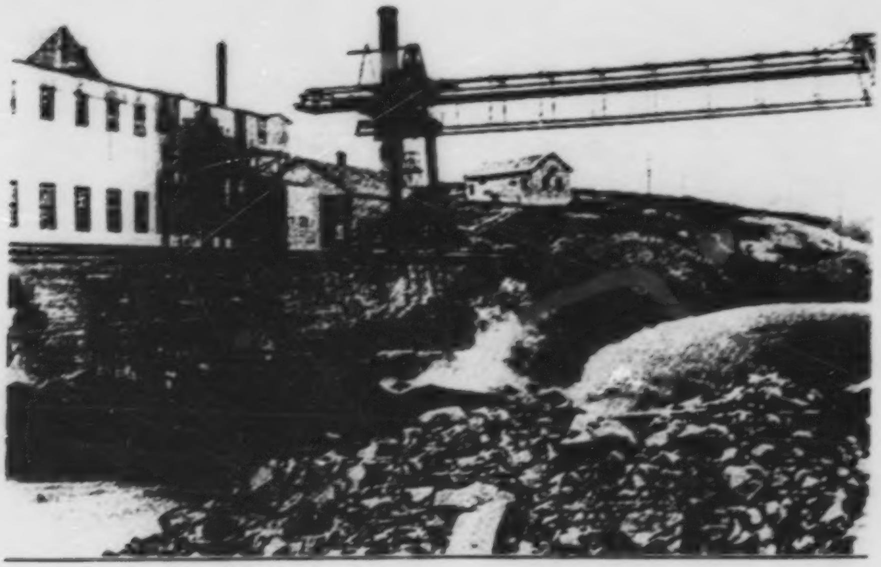


Photo 19i Sinter discharge into storage area at the Magpie Mine (Lindman and Bolton 1917). In 1983, only the concrete foundations remain and the area is forested with trees up to 0.3 m thick.

APPENDIX I PROPERTY DESCRIPTIONS

Properties will be described in alphabetical order for each township. Major properties have been subjected to more than one exploration effort and an attempt will be made to summarize them in chronological order. Descriptions will be by showing name and not company name and the name used for each showing will be the one currently in common usage. Extensive use of the Assessment Review Files Office (AFRO), Toronto has been made in preparing the property descriptions.

ABOTOSSAWAY TOWNSHIP

During routine mapping samples were collected from various outcrops displaying alteration and mineralization. These samples were routinely assayed for gold and checked for base metals. One sample of iron formation collected west of Jackson Lake on a unnamed lake returned 0.04 ounces Au per ton (see data compilation map). This assay was the only significant value obtained during mapping of Abotossaway Township and warrants follow-up work. The iron formation occurred within intermediate to mafic metavolcanic rocks cut by quartz-feldspar porphyry.

Moore (1931) indicated two adits at the eastern end of Murphy Lake. There is no record for this work or of what was found.

AMAX EXPLORATION INCORPORATED (1)

Amax Exploration Incorporated compiled available airborne geophysical data on a large area of the Wawa supracrustal rocks (Gillan 1979). These geophysical data were from private and public (AFRO) sources. On the basis of this compilation the company drilled two diamond drill holes in Abotossaway Township to test geophysically indicated electromagnetic conductors.

DRILL HOLE 989-13-1 (1-A)

This hole was completed on the anomaly "D" which anomaly on the basis of ground follow-up geophysics was indicated to have a short strike length (length unspecified), high conductivity and lacked geological explanation for its presence (Watts 1980, p.20). The drill log indicates mafic feldspar porphyry, mafic tuff and mafic lapilli tuff as the dominant rocks. A 13.9 m thick unit of metasediment was recorded. The conductor was identified as a 1 m thick unit of cherty sulphide iron formation from 81.8 to 82.8 m. The sulphide composed 15% of the core and was reported to be dominantly pyrrhotite (AFRO, Toronto). The iron formation assayed nil Au, 0.2 ounces Ag per ton, 130 ppm Cu and 145 ppm Zn (AFRO, Toronto). A sample from 71.3 to 71.5 m returned 0.04 ounces per ton gold (AFRO, Toronto). All other reported assays were nil.

DRILL HOLE 989-13-2 (1-B)

This hole was completed on anomaly "G" which on the basis of ground geophysics had been indicated to have a short strike length (length unspecified) and to be very conductive (Watts 1980 p.21). The drill log indicates a dominant lithology of intermediate tuff and lapilli tuff with greatly subordinate wacke (AFRO, Toronto). Two conductors were identified between 63.1 and 67.4 m and 86.3 and 87.3 m. The upper conductor was described as a siliceous lapilli tuff and the lower conductor as a siliceous sediment interbedded with lapilli tuff (AFRO). The upper conductor contained a average of 30% pyrite and pyrrhotite and the lower contained 25% disseminated pyrite (AFRO). The best reported assay lies below and in contact with the upper conductor from 67.0 to 69.8 m. This 2.8 m thick zone assayed 0.05 ounces Au per ton, 0.4 ounces Ag per ton, 288 ppm Cu, 53 ppm Pb and 2080 ppm Zn (AFRO).

BANVILLE - PAGE (2)

This showing has been described by Thomson (1921, p.23D) and Gledhill (1927, p.73). Thomson (1921, p.23D) reported that the gold showing occurs on claims 532 owned by J. Banville and O. Page.

Gold is reported to occur in cross cutting quartz stringers in a contorted banded iron formation (Thomson 1921, p.23D). The iron formation is reported by Thomson (1921, p.23D) to consist principally of quartz and carbonate in vertically dipping metavolcanic rocks striking at 105|. The iron formation is reported to be 6 to 10 feet wide and to have been pitted (Thomson 1921, p.23D). Minor chalcopyrite is reported to be present in the quartz stringers Thomson 1921, p.230; Gledhill 1927, p.73). This showing was not located during the present survey.

BONZANO EXPLORATION LIMITED

In 1984, Bonzano Exploration Limited held three staked claims numbers 671405 thru 671407 in the area of the Banville - Page showing. Claim 671405 covers the area of the former showing. The company completed magnetometer, electromagnetic, geochemical and geological surveys over the property (Ward 1984a, 1984b). The humus geochemical survey was conducted over claims SSM 671405 and a weak anomaly for gold was reported (Ward 1984b).

Ward (1984b, p. 1) reported that channel sampling near an old shaft returned values between 0.002 and 0.025 ounces per ton.

The shaft is reported to be 15 feet deep and there was limited diamond drilling completed in proximity to the shaft in the 1930's (Ward 1984a). The author could find no records for the drilling. Maps prepared by Bonzano Explorations Limited indicate the 15 foot shaft lies on claim SSM 671406 close to the south boundary of claim

SSM 671405.

BRANDT GROUP

Extensive prospecting activity is reported to have taken place on 14 claims between the road to the Murphy Mine and tracks of the Algoma Central Railway (Gledhill 1927, p.72). No record of this work was located. During mapping of this area in 1985, evidence of recent prospecting activity was encountered.

Gledhill (1927, p.72) reported that on Brandt Group claim A.C. 520 east of Jackson Lake a quartz vein containing chlorite, tourmaline, pyrite, chlcopyrite and coarse gold was observed. The exact location of this vein is uncertain, but its approximate location is indicated on maps prepared by Gledhill (1927).

CANDELA DEVELOPMENT COMPANY

A reconnaissance electromagnetic survey was run by Candela Development Company in the southeast corner of Abotossway Township (Sirola 1954a). Follow up work was not recommended (Sirola 1954a).

CLINE CLAIM (3)

A gold showing known as the Cline Claim (A.C. 452) occurs approximately 0.4 km southwest of the west end of Murphy Lake. Gledhill (1927, p.70) reported the vein system is 8 feet wide and strikes north. The vein system extends north-south for several hundred feet and was segmented into 3 to 4 sections by right lateral offset across northeast-striking strike-slip faults (Gledhill 1927, p.70). These faults follow general stratigraphic trends. Studemeister (1982, p.184, 189) described the showing as consisting of 50 cm to 2 m wide north- to northwest-striking steeply dipping quartz veins within the epidote-hornfels facies of contact metamorphism enclosing the Gutcher Lake Stock. The veins were described by Studemeister (1982, p.189) as polycrystalline quartz with minor ankerite, chlorite, muscovite, pyrite, pyrrhotite, chalcopyrite and sphalerite. Studemeister (1982, p. 189) reported the veins to be bordered by mesocratic calcite-quartz-chlorite schist grading outward into hornfels. Gledhill (1927, p.70) reported the best gold values were obtained from the north end of the vein. This showing was not visited by the field party.

A. COPPELLAN (4)

In 1969, Mr. A. Coppellan completed two diamond drill holes totalling 207.0 feet on claim SSM 100874. This claim is located on the west side of Jackson Lake. The drill logs indicate intermediate to mafic metavolcanic rocks and only disseminated pyrite mineralization was reported (AFRO).

DOHERTY LAKE SOUTH

Gledhill (1927, p.72) reported the presence of a gold-bearing quartz vein south of the narrows at the west end of Doherty Lake. He (Gledhill 1927, p.72) also reported work on a gold-bearing massive chalcopyrite fissure on former claim 648. The location of these showings is unknown.

ECCLES LAKE IRON FORMATIONS

Numerous small bands of cherty iron formation occur in the Eccles Lake area in the southwest corner of Abotossaway Township. These small relatively thin iron formation units are contorted. Collins and Quirke (1926, p. 95) reported iron formation bands from 3 inches to 20 feet wide and the author has observed iron formation in excess of 20 m at the north end of Eccles Lake. These iron formations consist of thin bedded chert, magnetite and wacke and occur at the intermediate to felsic to intermediate to mafic metavolcanic interface. Unpublished maps by Goodwin and Metcalf (1953) and observations by the field party indicate a stacking of lithologies or repetition of section which the author attributes to low angle oblique or strike-slip faulting. There was likely only one iron formation unit in the original undeformed stratigraphy. Bell (1905, p.333) recognized the fact that these iron formations were segments of a once continuous unit but did not suggest they were likely all of the same unit repeated by faulting. The author correlates these iron formations with the east end of the South Evans Creek Iron Range and eastward across the Marsdan Fault with the west end of the East Brooks Iron Range.

The facies of iron formation represented is only the upper portion of a typical Michipicoten iron formation. The small size of these iron formations suggests little economic importance to these iron formations as a source of iron. They may warrant prospecting for gold if cross-cutting quartz vein structures can be found.

Collins and Quirke (1926, p.94) reported that the iron formations in the Eccles Lake area were discovered and prospected by Mr. John Holdsworth in 1919 after a forest fire denuded the area; however, these iron formations were described by Bell (1905, p.332, 333) 15 years previously.

EGO RESOURCES LIMITED (5)

Ego Resources Limited controls a block of claims in central Abotossaway Township. These claims have undergone considerable exploration for gold and base metals. Table 10 gives the total footage of diamond drilling on the property.

Gledhill (1927, p.20) reported that the Barnes Copper claim occurs one mile northwest of Murphy Lake on the north edge of the Gutcher Lake Stock. This claim may be the present mineralized "C" Zone. This claim hosted massive chalcopyrite in narrow highly sheared structures and thin units of iron formation are reported to be present (Gledhill 1927, p.70). The geology described by Gledhill (1927) is comparable to that at the "C" Zone. Gledhill (1927, p.70) reported the presence of several ounces silver per ton in the massive chalcopyrite.

Moore (1931, p.25) described a "Barnes Claim" at the northwest corner of the Gutcher Lake Stock near Irene Lake. The geology described by Moore (1931, p.25) is that of quartz veins and may not be equivalent to what is now known as the W-8 Zone. Moore (1931, p.25) reported the presence of cobalt bloom in addition to quartz, carbonate, pyrite and chalcopyrite veins. The veins have a 70E strike and dip north (Moore 1931, p.25).

The present property results from staking by L. Mallette in 1955 on what was called the Mall Lake copper property (Goodwin 1958a). This staking would cover what is presently referred to as the "B" and "C" Zones.

In brief, the copper and gold mineralization occurs in the thermal aureole of contact metamorphism enclosing the Gutcher Lake Stock. On the north side the mineralization consists of gold and copper in thin lenses of massive chalcopyrite and on the south side the mineralization consists of gold in quartz veins. The mineralization on both the north and south side of the stock occurs in intensely sheared rocks. The thermal aureole is of the epidote hornfels facies of contact metamorphism and extensive diking by quartz-feldspar porphyry has taken place. Minor feldspar porphyry and aplitic dikes are present and the felsic diking is related to the Gutcher Lake Stock.

There are minor units of chert-magnetite iron formation in the stratigraphy.

The mineralization on the north side of the stock is coarse-grained and conformable to the shearing or occupies crosscutting fractures. The mineralization displays an epigenetic relationship with the host rocks. The gold mineralization on the southern margin of the stock lies within quartz veins lying within and parallel to shear zones.

Over the years numerous reports and maps have been prepared on the property. Mr. J. Tindale, Vice President Ego Resources Limited made available a large volume of data on the property from which this report has been prepared.

Figure 35 illustrates the mineralized zones found south of Mall Lake. Of these two zones only the "C" and W-8 Zones have been extensively tested. On the south flank of the stock a showing known as the southwest showing was briefly examined by the company. Figure 36 indicates the position of minor showings and exploratory diamond drilling lying outside the main mineralized zones.

W-8 ZONE (5A)

The W-8 Zone was explored by adit between 1976 and 1978 by Ego Mines Limited in partnership with United Canso Oil and Gas Limited. The adit cuts intermediate to mafic metavolcanic rocks cut by trondhjemite dikes from the Gutcher Lake Stock. As accessory minerals, sulphides with biotite appear approximately 15 m from the adit portal in quantities of 1 to 5% (Studemeister 1982, p.88). Studemeister (1982, p.88) reported that 40 m from the portal pyrite, pyrrhotite and chalcopyrite occur in quantities up to 25% as disseminations and stringers oriented parallel to subparallel to the metavolcanic host rocks. Subrounded to subangular felsite and cherty clasts are scattered in the mesocratic matrix (Studemeister 1982, p.91).

Beyond 40 m the metavolcanic schists contain bands or pockets with up to 30% disseminated and stringer pyrite, pyrrhotite and chalcopyrite (Studemeister 1982, p.91). Studemeister (1982, p.91) reported the presence of accessory actinolite, sphalerite, cobaltite, arsenopyrite, native gold and carbon material. Studemeister (1982, p.91) reported the sulphide distribution to be erratic.

Studemeister (1982, p.92) reported vein structures with mesocratic chloritic clasts in a matrix of chalcopyrite, pyrite, quartz, pyrrhotite, calcite and chlorite. These veins are reported by Studemeister (1982, p.92) as containing between 25 and 60% chalcopyrite, pyrite and pyrrhotite with accessory sphalerite, cobaltite, arsenopyrite and native gold.

Studemeister (1982, p.92, 93) interpreted the biotite, quartz, chlorite schists in the vein wall rocks as mudstones and that the sulphides are syngenetic. Crosscutting sulphide quartz carbonate veins were interpreted by him (Studemeister 1982, p.92, 93) to be later fracture fillings but due to similar mineralogy the time span separating the two was short. The author considers the wall rock schists to be sheared and altered intermediate to mafic metavolcanic rocks and that the sulphides are epigenetic in origin. If the sulphides are syngenetic they have been remobilized and recrystallized and their present mode of occurrence is typical of a epigenetic deposit. Figures 35 illustrates the trend of the W-8 Zone which is at a high angle to the northeast-striking stratigraphy.

On the hill above the adit into the W-8 Zone a trench was located which contained a malachite- and azurite-stained sulphide bearing fracture. The minerals were chalcopyrite and pyrite. The trench was poorly exposed but the trend of the fracture was estimated to be approximately 120| and vertically dipping. The fracture occurred within massive and amygdaloidal intermediate to mafic metavolcanic rocks within the thermal aureole of contact metamorphism of the Gutcher Lake Stock. The relationship of the mineralized fracture to the mineralization exposed in the adit at the base of hill is uncertain.

A grab sample from a point in the fracture exposing 6 inches of massive sulphides returned 1.38 ounces Au per ton, 1.29 ounces Ag per ton and 10.2% Cu (Geoscience Laboratories). The sample also returned 485 ppm Co, 164 ppm Ni and 480 ppm Zn.

"C" ZONE (5B)

The "C" Zone was explored by decline between 1976 and 1978 by Ego Mines Limited in partnership with United Canso Oil and Gas Limited. The author visited the decline in 1978 during active sinking but it was water filled in 1985 when mapping of the area took place.

The "C" Zone consists of a series of 15 to 30 cm wide northwest-striking, steeply-dipping fractures filled with quartz, calcite, ankerite, chlorite and muscovite with 30 to 60% pyrite, chalcopyrite, pyrrhotite and sphalerite (Studemeister 1982, p.87).

In 1978, the author visited the face of the decline. The sulphides occurred as bands and wisps parallel to highly contorted schistose intermediate to mafic metavolcanic rocks. The sulphides consisted of coarse-grained chalcopyrite, pyrite and pyrrhotite. Granular cherty lenses were encountered which may be recrystallized cherty iron formation and rare knots of massive sulphide were noted.

The sulphides exposed in trenches above the decline occupy well-defined steeply-dipping fractures trending in a generally north direction at a sharp angle to the northeast-trending stratigraphy. Figure 35 illustrates the cross-cutting trend of the mineralized zone.

In trenches on the hill above the decline a malachite- and azurite-stained sulphide filled fracture within massive and pillowed intermediate to mafic metavolcanic rocks cut by quartz-feldspar porphyry was located. This trench lies within the thermal aureole of contact metamorphism of the Gutcher Lake Stock. Its relationship to the mineralization tested in the decline at the base of the hill is uncertain. The fracture trends at 130| dips 81|N and nearby schistosities in the metavolcanic rocks trend at 085| and dip 88| south.

A grab sample take from the fracture where it was 8 inches wide returned 0.27 ounces Au per ton, 1.42 ounces Ag per ton and 2.28% Cu (Geoscience Laboratories). The sample also returned 400 ppm Co, 670 ppm Ni and 850 ppm Zr

SOUTHWEST SHOWING (5C)

On the south flank of the Gutcher Lake Stock, a thin 10 to 20 foot band of cherty iron formation containing chalcopyrite-filled fractures is referred to as the Southwest Showing (see accompanying compilation map for Abotossaway Township). Mapping by United Canso Oil and Gas Limited indicates the iron formation occurs within intermediate to mafic metavolcanic rocks in close proximity to quartz-feldspar porphyry intrusions related to the Gutcher Lake Stock. The showing lies approximately 131.0 m feet south of the contact of the Gutcher Lake Stock with the enclosing supracrustal rocks.

United Canso Oil and Gas Limited completed two diamond drill holes on the southwest showing in 1977. Drill hole UC-2 reached a total depth of 226.0 feet cutting intermediate to mafic metavolcanic rocks, sericite schist, quartz-chlorite schist and iron formation (AFRO). The iron formation was cut from 23.0 to 41.5 feet and from 44.0 to 109.0 feet (AFRO). The upper band contained up to 30% magnetite and the lower band up to 50% pyrite and pyrrhotite (AFRO, Toronto). The best gold assay was 0.005 ounces per ton from 106.0 to 109.0 feet and the best Ag assays of 0.26 ounces per ton occurred at two locations; 97.0 to 102.0 feet and 106.0 to 109.0 feet (AFRO).

United Canso Oil and Gas Limited drill hole UC-3 was completed to a depth of 277.0 feet penetrating intermediate to mafic metavolcanic rocks, intermediate to felsic lapilli tuff, feldspar porphyry and granodiorite (AFRO). Pyrite and pyrrhotite mineralization of 5 volume% or more was encountered from 51.0 to 61.5 feet and from 67.8 to 77.5 feet (AFRO). Copper values ranged from 0.04 to 0.10%, Au from trace to 0.005 ounces per ton and Ag from 0.08 to 0.24 ounces per ton (AFRO). A quartz vein from 153.5 to 157.0 returned a trace of Au and 0.28 ounces Ag per ton (AFRO).

UNNAMED SHOWING (5D)

During mapping east of the road connecting the Ego Resources ramp at Mall Lake with the Murphy Mine a trench containing pyrite and chalcopyrite mineralization was found. This trench occurs on the hill southeast of the camp.

The trench exposes schistose intermediate to mafic metavolcanic rocks intruded by quartz-feldspar porphyry. The porphyry contained 10 to 15% quartz phenocrysts up to 3 mm in diameter in seriate distribution up to 3 mm in diameter. The feldspar crystals were also in seriate distribution, up to 2 mm in size and composed an estimated 5 to 10% of the rock. The trench followed a malachite and azurite stained pyrite- and chalcopyrite-filled fracture trending at 350| and dipping 83| east. Two assay samples were collected from the fracture where it traversed quartz-feldspar porphyry. The first sample returned 0.24 ounces Au per ton, 1.35 ounces Ag per ton and 6.5% copper (Geoscience Laboratories). The sample also contained 121 ppm Co, 62 ppm Ni and 225 ppm Zn. The second sample contained 0.06 ounces Au per ton, 3.84 ounces Ag per ton and 17.0% Cu (Geoscience Laboratories). The sample also contained 375 ppm Co, 115 ppm Ni and 2640 ppm Zn.

The showing is located in the inner portion of the thermal aureole of contact metamorphism enclosing the Gutcher Lake Stock. The trench may be on what is known as the 'South Vein' on Figure 35.

UNNAMED SHOWING (5E)

On the hill immediately west of the camp of Ego Resources Limited trenching of banded sulphide-bearing cherty iron formation was observed. The iron formation was highly contorted and could not be traced east or west for any distance. Bedded intermediate to mafic tuff and massive intermediate to mafic metavolcanic rocks occurred in association with the iron formation. The iron formation and metavolcanic rocks were intruded extensively by quartz-feldspar porphyry. The showing occurs within the thermal aureole of the Gutcher Lake Stock. Xenoliths of iron formation were observed in the quartz-feldspar porphyry.

A grab sample of the pyrite mineralization with the iron formation was collected for assay. This sample returned 0.01 ounces Au per ton, 0.22 ounces Ag per ton and 1.28% copper (Geoscience Laboratories). The sample also returned 390 ppm Cu, 41 ppb Ni and 70 ppm Zn.

UNITED CANSO GAS AND OIL LIMITED HOLE UC-1 (5F)

Diamond drill hole UC-1 was completed in 1977 to a total depth of 254.0 feet (AFRO). This drill hole encountered magnetite plus pyrrhotite from 40.0 to 43.0 feet and pyrrhotite plus pyrite in quantities exceeding 10% from 53.0 to 62.0 feet, 89.0 to 91.5 feet, 95.5 to 99.5 feet and 199.0 to 219.0 feet (AFRO). The best Cu assay was 0.12% from 215.0 to 219.0 feet; the best Au assay was 0.02 ounces per ton from 205.0 to 210.0 feet; and the best Ag assay was 1.04 ounces per ton from 40.0 to 43.0 feet (AFRO, Toronto). The drill logs indicate chlorite schist and intermediate to felsic metavolcanic rocks are dominant (AFRO). The intermediate to felsic metavolcanic rocks may be dike rocks. Most of the mineralized zones were logged as iron formation by the company (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-4 (5G)

United Canso Gas and Oil Limited hole UC-4 was completed to a total depth of 267.0 feet in 1977. The drill log indicates the drill hole intersected sericite-talc-quartz schist, chlorite schist, intermediate to mafic metavolcanic rocks and quartz veining (AFRO).

From 190.4 to 194.0 feet approximately 5% pyrite and pyrrhotite were encountered and from 209.5 to 218.0 feet an average of 3% pyrrhotite and pyrite are present (AFRO). All the copper assays were 0.02%, three Au assays were 0.005 ounces per ton and the best Ag assay was 0.30 ounces per ton from 140.5 to 146.5 feet (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-6 (5H)

Drill hole UC-6 reached a total depth of 455.0 feet in 1977 cutting intermediate to mafic metavolcanic rocks (AFRO). From 61.0 to 63.5 feet approximately 3% pyrite and pyrrhotite were encountered and from 349.0 to 350.0 feet an iron formation was intersected which contained an estimated 10% pyrite (AFRO). The mineralized sections were sampled but assays were not reported (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-8 (5I)

In 1977, drill hole UC-8 was completed to a depth of 150 feet by United Canso Gas and Oil Limited (AFRO), intersecting intermediate to felsic lapilli tuff, chlorite schist and sericite schist (AFRO). In excess of 10% pyrite and pyrrhotite was intersected from 92.0 to 103.0 feet and from 109.5 to 116.5 feet (AFRO). The core was sampled but assays were not reported (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-9 (5J)

Hole UC-9 was completed to a depth of 190.0 feet in 1977 cutting porphyritic rhyolite, altered dacite and quartz-chlorite schist (AFRO). The intermediate to felsic rocks may be intrusive rocks.

From 135.5 to 137.5 feet and from 141.0 to 153.0 feet, 5% or more pyrite and pyrrhotite were encountered (AFRO). Gold occurrence in only trace amounts; the best Cu assay was 0.10% from 135.5 to 137.0 feet; and the best Ag assay was 0.22 ounces per ton from 141.0 to 145.0 feet (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-10 (5K)

Hole UC-10 reached a depth of 144.0 feet cutting intermediate to felsic tuff and sericite schist (AFRO). Numerous sections of the core report up to 2% pyrite and pyrrhotite but the best pyrite and pyrrhotite mineralization occurs between 88.0 and 91.2 feet (AFRO). Numerous samples were taken but assays were not reported (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-11 (5L)

United Canso Gas and Oil Limited completed diamond drillhole UC-11 to a depth of 222.0 feet in 1977 (AFRO). This hole penetrated intermediate to mafic metavolcanic rocks and from 145.0 to 155.0 feet bands of sulphide were present within the metavolcanic rocks (AFRO). The best sulphide mineralization was in excess of 5% from 149.0 to 151.5 feet (AFRO). Copper assays ranged from 0.02 to 0.05%, Zn from 0.02 to 0.04%, Au from trace to 0.01 ounces per ton and Ag from trace to 2.0 ounces per ton (AFRO). The high Ag assay of 2.0 ounces was from 149.0 to 151.5 feet and all others were 0.24 ounces or less (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-12 (5M)

Diamond drill hole UC-12 was completed to a depth of 326.0 feet in 1977 penetrating intermediate to mafic metavolcanic rocks and some minor quartz veins (AFRO). Pyrite and pyrrhotite in quantities up to 40% was intersected from 84.5 to 126.0 feet (AFRO). Copper values ranged from 0.06 to 0.88%, Zn ranged from 0.02 to 0.06%, gold was present only in traces and Ag ranged from 0.01 to 0.52 ounces per ton (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-13 (5N)

United Canso Gas and Oil Limited diamond drill hole UC-13 was completed to a depth of 409.0 feet in 1977 cutting intermediate to mafic metavolcanic rocks and feldspar porphyry (AFRO). From 125.0 to 126.0 feet, 138.0 to 141.0 feet, 151.0 to 152.0 feet, 161.0 to 162.0 feet, 187.0 to 188.0 feet and 271.0 to 272.0 feet 5% or more pyrite and pyrrhotite was intersected (AFRO). Copper assays ranged from 0.01 to 0.30%, Co was consistent at 0.01%, Au varied from trace to 0.02 ounces per ton and Ag from 0.01 to 0.50 ounces per ton (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-14 (5O)

Diamond drill hole UC-14 was completed to a depth of 476.0 feet in 1977 intersecting intermediate to mafic metavolcanic rocks (AFRO). The drill log does not indicate the presence of mineralization or that samples were taken for assay (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-15 (5P)

United Canso Gas and Oil Limited diamond drill hole UC-15 was completed to a depth of 428.0 feet in 1977 penetrating intermediate to mafic metavolcanic rocks (AFRO). The drill log does not indicate the presence of mineralization or that samples were taken for assay (AFRO).

UNITED CANSO GAS AND OIL LIMITED HOLE UC-16 (5Q)

Diamond drill hole UC-16 was completed to a depth of 226.0 feet in 1977 intersecting intermediate to felsic metavolcanic rocks and quartz-feldspar porphyry (AFRO). In excess of 10% pyrrhotite and pyrite was intersected from 48.0 to 54.0 feet, 61.0 to 62.0 feet, 67.0 to 68.0 feet, 82.5 to 83.5 feet and 104.0 to 105.0 feet (AFRO). Chalcopyrite was reported in the sulphide sections but assays for copper indicate very little to be present. Copper values ranged from 0.13 to 0.61%, Co from 0.01 to 0.02%, Au from trace to 0.12 ounces per ton and Ag from 0.06 to 0.36 ounces per ton (AFRO). All gold assays were trace only with exception of the section from 104.0 to 105.0 feet which returned the 0.12 ounces Au per ton (AFRO).

EGO MINES LIMITED

The first major drill program on the property took place in 1959 following surface trenching and prospecting (Ringsleben and Burns 1960, p.1). This work consisted of 24 diamond drill holes totalling 16, 437 feet which disclosed values in gold, silver copper and cobalt; but gold and copper were considered to be the only two metals of economic importance (Ringsleben and Burns 1960, p.4). This work was directed by C.A. Burns, consulting geologist and directed to what is presently known as the West Central and Central Vein Zones (Figure 35).

In 1960 to 1961, the property was geologically mapped following the completion of electromagnetic and magnetic surveys in 1958 and 1959 (Vallance 1961, p.1, 2). A 25 hole diamond drill program totalling 9,759 feet followed the survey work (Vallance 1961, p.2). As with the first work the efforts were concentrated in the West Central and Central Vein Zones. This work further established the main values to be in copper and gold.

In 1964, Vallance (1964a, p.45) reported the discovery of a mineralized zone by Mr. P. Doyon east of a diabase dikes. The assay values reported (Vallance 1964a, p.5) indicate values in Cu, Ag and Au. The location of this discovery was not given.

As a result of prospecting and trenching in 1963 and 1964 Vallance (1964b, p.1, 3) recommended additional diamond drilling.

In early 1965, the company completed a series of 16 diamond drill holes and an estimate of tonnages in the various zones (Vallance 1965a, p.1). The tonnages estimated by Vallance (1965) are given in Table 11.

Following the initial drill program, line cutting, geochemical survey and a magnetometer survey were completed over geochemically anomalous areas (Vallance 1965b).

Ringsleben and Burns (1965) summarized the work up to an including the 16 diamond drill holes and recommended additional work.

An additional 6 diamond drill holes were completed bringing the total holes drilled to 71 and an additional 5 packsack drill holes were completed in 1965 (Vallance 1965b, p. 1, 7). Vallance (1965b, p.5, 6) mentioned the discovery of chalcopyrite mineralization near a diabase dike. Vallance (1965b, p.6) reported this zone to be 110 by 11.0 feet and grading 1.49% Cu. The location of this showing is not known. Vallance (1965b, p.6) reported pitting and trenching on a molybdenite showing displaying mineralization over a width of 4 feet but the precise location of this occurrence is unknown. Studemeister (1982) mapped a molybdenite occurrence (perhaps the same one) on the east side of the Gutcher Lake Stock but did not describe the showing. Ringsleben and Burns (1967, p.2) prepared a summary report on the property and noted that 117 diamond drill holes had been completed and that induced polarization surveys had been completed over Mall Lake. It was estimated from drill sections that the property hosted 320,532 tons (not diluted) grading 1.84% Cu and 0.135 ounces Au per ton (Ringsleben and Burns 1967). Underground examination and additional surface diamond drilling on the W-8 Zone was recommended (Ringsleben and Burns 1967). Burns (1968) also recommended additional surface drilling on the W-8 Zone.

In 1969, 6 diamond drill holes were completed on the property 4 of which were on the W-8 Zone (Vallance 1971, p.8). At this time, Vallance (1971, p.7) indicated 7 mineralized zones were known on the property. The work to date indicates that the "B" zone does not extend to depth but that a zone 100 feet east of B has continuity at depth (Vallance 1971, p.15). This zone is known as the "C" Zone. Table 12 gives the drill indicated tonnages calculated by Vallance (1971).

Burns (1973, p.4) prepared a brief report on the property recommending bulk sampling on Central, Southern, W-8 and "C" zones, prospecting for gold on the southern portion of the property and underground sampling of the W-8, "C", North Porphyry and South Zones.

In 1974, Kidd (p.2) prepared a lengthy report on the property stating 8 mineralized zones were present containing 370,000 short tons grading 1.60% Cu and 0.11 ounces Au per ton. Kidd (1974, p.14, 15) concluded that the potential for additional tonnage was good and recommended underground sampling. Kidd (1974, p.15) recommended additional surface diamond drilling.

UNITED CANSO OIL AND GAS LIMITED

In October 1976, Ego Mines Limited optioned the property to United Canso Oil and Gas Limited (Canadian Mines Handbook 1977-78, p.113). During 1976 and 1977, United Canso Oil and Gas Limited completed electromagnetic and magnetic surveys over the property (Woodard 1977; Morrison 1977a, 1977b). An induced polarization survey was completed in 1977 on the southwest group of claims and resulting IP anomalies tested by diamond drill holes UC-2 and UC-3 (Morrison 1978, p.10).

The drilling was completed under an option arrangement with Union Miniere Explorations and Mining Corporations Limited. This drilling failed to disclose significant mineralization and it was recommended that the claims be dropped. A geological report on claim SSM 407890 within the Gutcher Lake Stock did not describe mineralization in the central portion of the property (White 1978). In 1977, the company completed 20 diamond drill holes totalling 6,767 feet (AFRO). The position of these holes are given on the compilation map for Abotossaway Township and Figure 35. In 1977 a decline totalling 147 feet was driven on the "C" Zone and a adit was driven on the W-8 Zone (Canadian Mines Handbook 1978-1979, p.108; AFRO).

Holes UC-2 and UC-3 were drilled on the SW showing (see compilation map). Holes UC-17, 18, 19 and 20 were drilled on the main zone, UC-5 was drilled across the mouth of the decline on the "C" Zone and hole UC-7 was drilled west from the mouth of the adit on the W-8 Zone. These holes are positioned on Figures 35 and 36. Hole UC-16 drilled to the east intersected minor gold mineralization. This hole is located on Figure 36. Holes UC-1, 4, 6, 8 9, 10, 11, 12 and 13 encountered uneconomic or barren mineralization and are also located on Figure 35. Diamond drill holes 14 and 15 were barren. The mineralized holes have been previously described at locations 5F through 5Q.

McGinn (1982) prepared a summary report on the Ego Mines Limited Property. The mineralization occur in 3 settings (McGinn 1982, p.4). These settings are as follows:

1: In the main zone, 5 mineralized zones occur in sericitized shear zones. The mineralization consists of veinlets, disseminations and lenses of chalcopyrite, pyrrhotite, and pyrite in widths from a few inches to 10 feet. The veins carry Cu, Au, Co and Ag and are frequently offset by small cross faults.

2. The southwest vein of the Main Zone may be a replacement vein. It is concordant and consists of quartz, carbonate, pyrite, chalcopyrite, sphalerite, gold and silver.

3. In the W-8 and B-C zones the mineralization occur in crosscutting faults striking N 20 to 80 west. The mineralization consists of stringers and lenses of massive sulphides from a few inches to several feet thick. The mineralization consists of pyrite, chalcopyrite, magnetite, gold, silver and cobalt.

Between 1979 and 1980, Ego Mines Limited become Ego Resources Limited (Canadian Mines Handbook 1978-1919, p.108; Canadian Mines Handbook 1979-1980, p.104). Ego Resources Limited retains a 92% interest in the former Ego Mines Limited property (Canadian Oil and Gas Handbook 1984-1985, p.91, 92).

FARQUHAR VEIN (6)

The Farquhar Vein has been known as the Farquhar Property since claims covering the vein were patented in 1927 (Halstead 1959a, p.5).

Gledhill (1927, p.69) described the quartz vein as occurring in sheared pyritized granodiorite. The vein consists of glassy quartz with local coarse gold (Gledhill 1927, p. 69). Gledhill (1927, p.69) reported the presence of accessory pyrite chalcopyrite, pyrrhotite and sphalerite in the vein. Black tourmaline and ankerite occur in the quartz vein and wall rock and biotite is present in the chloritic wall rock (Gledhill 1927, p.69).

Geologic mapping by Rio Tinto Canadian Exploration Limited indicates a shear-vein structure that strikes just north of east at the west end and swings north to approximately 60 at the east end. The vein follows the general trend of the stratigraphy. The vein structure was mapped by Rio Tinto Canadian Exploration Limited as having a length of approximately 1100 m.

Kemp (1981, p.5) reported that the vein-shear zone roughly parallels the contact between the Gutcher Lake stock and surrounding intermediate to mafic metavolcanic rocks. Kemp (1981, p.5) described the shear as dipping north from 85| to vertical and that it has a width of 1 to 7.2 m. Within the shear a quartz-carbonate vein is present which varies from 0.3 m to 1.1 m in width and averages 0.45 m. The shear is made up of chlorite and sericite schists and the quartz pinches and swells along strike (Kemp 1981, p.5). Kemp (1981, p.5) reported that pyrite is the dominant accessory sulphide mineral but that sphalerite galena, chalcopyrite, marcasite and pyrrhotite have been observed. Surface sampling indicated erratic gold values along the vein with the best results in trenches F and G (see Figure 36). Trench "F" ran 0.38 ounces over 1.8 m and trench "G" ran 0.34 ounces over 1.02 m (Kemp 1981, Appendix 1). Most surface samples ran 0.05 ounces per ton or less.

Studemeister (1982, p.189) reported the Farquhar vein to contain up to 20% sulphide as pyrite, pyrrhotite, sphalerite and chalcopyrite. The showing was not visited during the present survey.

GOLDEN ALGOMA MINES LIMITED

Halstead (1960a, p.6) recommended surface sampling and diamond drilling of the Farquhar prospect to Golden Algoma Mines Limited. Records donated to the survey by Mr. Sid Rossen suggest that Golden Algoma Mines Limited drilled 15 holes totalling, 3318.0 feet on the vein. A plan map showing the location of these holes could not be located and the relationship of this drilling to the vein and to the later work by Rio Tinto Canadian Exploration Limited is unknown. Table 13 gives the gold values in excess of 0.10 ounce reported on the drill logs. Using holes F-1 and F-2 and F-6 and F-7 which were drilled below each other a dip to the north of between 67 and 77| is indicated.

RIO TINTO CANADIAN EXPLORATION LIMITED

In approximately 1980, Rio Tinto Canadian Exploration Limited optioned the Farquhar vein from Farquhar Mines Limited. The company completed a VLF electromagnetic, magnetic and geological Survey over the property. A simplified sketch of the geology as interpreted by Rio Tinto Canadian Exploration Limited is given in Figure 37 (AFRO). The company completed surface sampling and drilled 6 diamond drill holes totalling 483.5 m (AFRO). Significant gold assays from the drilling is reported in Table 13.

GETTY MINES LIMITED (7)

Getty Mines Limited completed an airborne electromagnetic and magnetic survey over Abotossaway, Corbiere and Aguonie townships in 1973 (Fraser 1973). Some of this early work is described by Bryant et al. (1972) and Reilly (1973). The company established the Middleton, Kozak, "B" and "F" grids, in Abotossaway Township. On grid "B" near Byron Lake the company completed soil geochemistry for copper and zinc, a VLF-EM (Radem) Survey and a ground magnetic survey (Bryant and White 1974, p.57, 58). Follow up diamond drilling was not recommended (Bryant and White 1974, p.59).

On grid "F" at Eccles Lake (local name) the company completed soil sampling for geochemical testing of copper and zinc but never completed the analyses (Bryant and White 1974, p.80). It was recommended that no further work be done (Bryant and White 1974, p.81).

MIDDLETON GRID, GETTY DRILL HOLE GO-6 (7A)

To investigate airborne-indicated conductors Getty Mines Limited completed geological mapping, soil geochemistry for copper and zinc and recommended that the conductor in Middleton Lake be diamond drilled (Bryant and White 1974, p.82-90). In 1974, two diamond drill holes (GO-6 and Middleton) totalling 525 feet were drilled in Middleton Lake (AFRO). In hole GO-6, 328.0 feet of intermediate to mafic tuff and chert, siderite and sulphide iron formation cut by quartz porphyry was encountered. Pyrite and pyrrhotite locally formed up to 5% of the iron formation and some sulphide occurred in the mafic tuffs. Samples taken for assay returned trace to 0.02% Cu and trace to nil gold (AFRO).

The second hole known as the Middleton hole logged quartz porphyry, intermediate to mafic tuff and thin units of chert, siderite and sulphide iron formation (AFRO). Minor pyrite and pyrrhotite were reported and no assays were given (AFRO).

KOZAK GRID, GETTY DRILL HOLE GO-5 (7B)

On the basis of airborne geophysical survey-indicated conductors, the company laid out a grid between Byron and Kozak Lakes. The company completed geological mapping, geochemical soil sampling for copper and zinc and ground magnetometer and VLF-EM (Radem) surveys on the grid (Bryant and White 1974, p.44, 45). On the basis of the ground work, diamond drilling was recommended (Bryant and White 1974, p.46). One diamond drill hole (GO-5) was completed to a depth of 200 feet. The drill log reports the presence of diorite, intermediate to mafic and intermediate to felsic metavolcanic rocks and banded and brecciated chert, siderite and sulphide facies iron formation (AFRO). Pyrrhotite and pyrite were reported to comprise up to 25% of the iron formation (AFRO). Assays for copper ranged between 0.01 and 0.38% for zinc trace to 0.47% and trace of gold (AFRO).

GLENBURK MINES LIMITED

Glenburk Mines Limited is reported to have completed work in Abotossaway Township but no records for this work could be located (AFRO).

INTERNATIONAL CORONA RESOURCES LIMITED (43)

As a follow up to an airborne magnetic and electromagnetic survey completed in 1983, Manwa Exploration Services Limited briefly ground checked a number of conductors in Abotossaway Township (Neelands et al. 1984a). The findings are tabulated in Table 14 and relative position indicated on the accompanying compilation map. Most conductors are clearly iron formation and most occur on iron ranges having undergone previous prospecting activity. The reader should refer to the original report for details (Neelands et al. 1984a).

JONSMITH MINES LIMITED

Jonsmith Mines Limited is reported to have carried out work in Abotossaway Township but no records for this work could be located (AFRO).

KOZAK PROPERTY (8)

The Kozak property lies in the southeast corner of Abotossaway Township and was staked by Mr. Nick Kozak in 1927.

The dominant rock unit hosting the mineralization is a intermediate to felsic feldspar crystal tuff. In the areas stripped north, east and south of the Kozak shaft intermediate to felsic lapilli tuff, breccia and flow banded flows were observed. The rocks are very schistose, heavily carbonated and scattered isolated grains of chloritoid were observed southwest of the shaft (Plate 12). The mineralization consists of galena, pyrite, chalcopyrite and sphalerite in association with quartz and carbonate along narrow (up to 4 to 5 cm) wide fractures and in association with somewhat thicker granular white quartz veins (Plate 13). The quartz veins vary widely in width and were of variable strike. Moore (1931, p.25) reported the presence of argentite and secondary native silver. Moore (1931, p.26) reported that interesting surface silver values did not extend to depth except within the fractures themselves implying some shallow surface enrichment due to weathering. Hurst (1928, p.78) also described the mineralization as erratic. Assay values obtained by the Ontario Geological Survey on grab samples collected from trenches near the shaft are given in Table 15.

During 1927 and 1928 MacLeod (1927) and Hopkins (1928) visited the property and obtained interesting but erratic values in gold and silver on samples collected by them. Both investigators had doubts as to the commercial viability of the property (MacLeod 1927, p.1; Hopkins 1928, p.4).

NIPISSING MINING COMPANY

Soon after discovery the showing was optioned to the Nipissing Mining Company (Hurst 1928, p.78). There is no record of work by this company.

N. TIMMINS INCORPORATED

The Nipissing Mining Company soon terminated its option and in the same year (1927) N. Timmins Incorporated optioned the property. Hurst (1928, p.78) mentioned that stripping and trenching had taken place and that diamond drilling was planned. There is no record of diamond drilling having been completed. Hopkins (1928, p.2) mentioned the property was under option to Mr. Alderson and Mr. Mackay at this time and the author assumes that these gentlemen were representing N. Timmins Incorporated.

KOZAK GOLD MINES LIMITED

According to the Canadian Mines Handbook (1935, p.136) the Kozak property was under control of Kozak Gold Mines Limited at this time. This company was incorporated in 1934 and its charter cancelled in 1952 (Canadian Mines Register of Dormant and Defunct Mines p.213). Kozak Mines Limited became Maralyo Mines Limited (Canadian Mines Register of Dormant and Defunct Mines, p.213), whose charter was cancelled in 1970 (Canadian Mines Register of Dormant and Defunct Mines, second supplement p.52). The relationship between Kozak Gold Mines Limited and Kozak (Mines Limited) is uncertain. Kozak Mines Limited is reported to have been incorporated in 1928 (AFRO, Toronto) and may have in some form or another preceeded Kozak Gold Mines Limited, however the possibility exists that the two companies are independant. Regardless of the ownership apparently only surface work was completed by the company (AFRO).

ORECANA MINES LIMITED

In 1934 Orecana Mines Limited optioned the property from Kozak Gold Mines Limited and sank a two compartment 6 by 8 foot shaft to 110 feet and established two levels at 35 and 100 feet (AFRO; Sinclair 1935, p.131). The company is reported to have driven 316 feet of development drift (AFRO). The author could not locate any technical records of Orecana Mines Limited. Orecana Mines Limited ceased to exist in 1938 (Canadian Mines Register of Dormant and Defunct Mines, p.295).

AMERICAN YELLOWKNIFE GOLD MINES LIMITED

The property was taken over in 1952, by American Yellowknife Gold Mines Limited. This company dewatered the shaft and completed a surface and underground sampling program. This work confirmed the presence of erratic values in gold, silver, lead and zinc (AFRO). The shaft vein is reported to have assayed 0.25 ounces Au and 11.2 ounces Ag per ton over an average width of 2.9 feet for a length of 45.0 feet (AFRO). American Yellowknife Gold Mines Limited became American Yellowknife Mines Limited which changed its name to Rayrock Mines Limited (Canadian Mines Handbook 1956, p.10) Rayrock Mines Limited became Rayrock Resources Limited in 1978 (Canadian Mines Handbook 1984-1985, p.322).

ADONIS MINES LIMITED

Adonis Mines Limited took over the property in 1959 (AFRO). The Company completed an electromagnetic survey over the property and a magnetic survey near the shaft (Sheridan 1960). The company completed a diamond drill program totalling 71 holes for 17,440 feet and prepared a geological map of the property (Williams 1960; Hoshkim 1960; Campbell and Williams 1961; AFRO). The tabulated drill hole data is given in Table 16 and the position of the holes given in Figure 37. Williams (1960, p.8) and Campbell and Williams (1961, p.4) recommended underground investigation of the property. In 1962, the claims reverted to the Algoma Central Railway (AFRO).

FORDHAM, J.

In 1963, the property was leased by Mr. Jack Fordham from the Algoma Central Railway. Mr. Fordham is reported to have completed one diamond drill hole totalling 702 feet for assessment purposes but the author could not locate records for the drill hole (Brewster 1979, p.3).

LAKE KOZAK MINES LIMITED

In 1965, Lake Kozak Mines Limited optioned 5 claims covering the main showing from Mr. Fordham. The company completed an additional 24 surface diamond drill holes in 1967 totalling 3,558.6 feet, constructed a railway siding and slashed and retimbered the shaft (Williams 1968, p.4). The company completed 1,116 feet of underground diamond drilling in 12 holes in 1967 and 1968 in 12 holes and was prepared to undertake additional underground examination (Williams 1968, p.4). The underground work has been recommended by Williams (1967, p.5). Brewster (1979, p.3) reported that the company had completed 345 feet of drifting in 1968 and underground drilling continued until a total of 21 holes were completed for a total of 2,438 feet of drilling. The company abandoned the claims in 1969 (Brewster 1979, p.3).

A.C. A. HOWE INTERNATIONAL LIMITED

In 1973 the claims were acquired by A.C.A. Howe International Limited who did not perform any work on the property (Brewster 1974, p.4).

LAURASIA RESOURCES LIMITED

In 1974, Laurasia Resources Limited acquired the property from A.C.A. Howe International Limited (Brewster 1979, p.4). The company in 1974 completed a program of surface sampling over the central parts of the property disclosing gold and silver mineralization (Huxhold 1974, p.10) The company completed no further work.

GOLDEN SPOKE MINES LIMITED

Golden Spoke Mines Limited optioned the Kozak property from Laurasia Resources Limited in 1979 (Brewster 1979, p.1). Golden Spoke Mines Limited completed geological, geophysical and geochemical surveys over the property (Anonymous 1981, p.7). During December and January 1981, the company carried out a 13 hole diamond drilling program totalling 4241.3 feet (Anonymous 1981). This work in combination with interpretation of earlier work delineated 5 zones of mineralization which are outlined on Figure 38 along with the position of the drill holes. Estimates as to grade and volume of material are given in Table 17. There is no record of subsequent work on the property but additional work was recommended (AFRO; Anonymous 1981, p.16, 17).

R.J. MCGOWAN

R.J. McGowan held 20 claims in Abotossaway Township in 1984.

One claim was located south of Irene Lake, a second north of Gutcher Lake, three east of Selkirk Lake and the remainder between Rowan Lake and the east boundary of the township. Ground magnetometer and VLF-EM surveys were completed over the claims and numerous conductors identified but no follow-up work has been reported (Reid and Sears 1984a).

MCMAHON CLAIM

Gledhill (1927, p.71,72) reported the presence of visible gold in quartz near the centre of claim 1712. This claim straddles the Abotossaway-Aguonie Township boundary approximately 1 km north of Goudreau. The precise location of this showing is unknown.

MURPHY GOLD MINE (9)

The Murphy gold mine is the only past producing gold mine in Abotossaway Township (Plate 14). The property has undergone considerable exploration and development since gold was found at the site by Mr. Thomas Murphy in 1921 (Burrows 1921, 1922; Thomson 1921; p.250)

The Murphy gold mine is located on a quartz-carbonate vein cutting hornfelsed intermediate to mafic pillowed and massive metavolcanic rocks and associated quartz-feldspar porphyry intrusions. The quartz-feldspar porphyry intrusion is an apophysis of the Gutcher Lake Stock. The vein is in excess of 500 m in length, steeply dipping or subvertical at surface and commonly consists of equal parts carbonate plus quartz. The vein may be up to 5 m wide but varies in width considerably along strike. The carbonate is fine to coarse-grained and weathers a distinctive rusty brown typical of ankerite. The quartz is of at least two ages with a more granular quartz appearing older than a cross cutting more glassy appearing quartz. The quartz varies from grey to milky white in colour. Traces to minor quantities of pyrite and chalcopyrite are present in the veins and visible gold can be collected from the Murphy Mine dumps. Studemeister (1982, p.181) reported a sulphide content of up to 20% in the vein material but this high sulphide content could not be confirmed by the author. In addition to pyrite and chalcopyrite, Studemeister (1982, p.181) reported the presence of pyrrhotite, sphalerite, chlorite, muscovite, albite, tourmaline, galena and arsenopyrite in the vein. Black amorphous carbon is reported to be associated with sulphides in the eastern part of the vein and some of the pyrite is reported to contain 3% cobalt (Studemeister 1982, p.183). Studemeister (1982, p.183) reported that colloform pyrite surrounds pyrrhotite grains in the eastern part of the vein.

The western part of the vein is bordered by fine-grained leucocratic chlorite-albite, calcite-ankerite-white mica-quartz schists which grade outward into gneissic trondhjemite

(Studemeister 1982, p.182). The trondhjemite is part of the Gutcher Lake Stock and schists bordering the vein sheared trondhjemite.

The eastern end of the vein is bordered by mesocratic chlorite- quartz-calcite-muscovite-pyrrhotite-pyrite-tourmaline schists (Studemeister 1982, p.183). Studemeister (1982, p.184) reported that the texture of the rocks changes gradually from granoblastic at distances of 3 m of more from the vein to schistose at the vein walls. Collins and Quirke (1926, p.130) reported the Murphy vein to be 800 feet in length, 1 to 10 feet in width, striking 90 to 115| and dipping 60| south to vertical. They described left-lateral offset across the 140| striking diabase dike near No.1 shaft as being 76 feet. MacLeod and Cowie (1926) described a 76 foot offset but state the vein is 1200 feet in length. In addition to the vein minerals mentioned by the author and Studemeister (1982), Collins and Quirke (1926, p.130) mentioned the presence of bornite, niccolite and smaltite - chloanthite. In the same report, Thomson (1926, p.160) described the vein as over 1,000 feet in length and having a maximum width of 4 feet. Thomson (1926, p.160) noted that the smaltite-chloanthite and niccolite occurs close to the number one shaft and close to the diabase dike.

The niccolite and chloanthite-smaltite occurs in association with carbonate (Thomson 1926, p.160).

Gledhill (1927, p. 65-69) described the Murphy deposit after completion of development. Gledhill (1927, p.6) observed that the Murphy Vein was truncated by a northeast-striking shear zone at its western extremity at the margin of the Gutcher Lake Stock. A 60 foot wide northwest-striking diabase dike cuts the Murphy Vein near the No.1 shaft (Gledhill 1927, p.67). This dike occupies a fault zone and has been brecciated along its borders (Gledhill 1927, p.67). Gledhill (1927, p.67) observed a steep southwest dip to the dike near surface which swings to the northeast at depth. Gledhill (1927, p.67) observed the presence of cobalt and nickel arsenides and antimonides near the dike walls which be considered unrelated to the gold mineralization.

Gledhill (1967, p.67) described the Murphy vein as being 1400 feet long and 2 to 3 feet wide. A zone of coarse-grained gold is reported to be present near the No.1 shaft and to extend to a depth of at least 100 feet (Gledhill 1927, p.68).

Gledhill (1927, p.68) reported that chlorite is common in gold-bearing quartz and that locally this chlorite has been altered to a biotite and sericite mixture with minor tourmaline. Horizontal movement along the vein walls was suggested by Gledhill (1927, p. 68) where he observed horizontal striae and burnished pyrrhotite at the vein-wall rock contact.

Gledhill (1927, p.69) proposed that the coarse gold occurred at the junction of crushed porphyry dikes and quartz-veins in response to alkali-rich hydrothermal solutions derived from the porphyries. The coarse gold is reported to occur in dark quartz

(Gledhill 1927, p.69).

Moore (1931, p.23) reported the Murphy vein to be 1675 feet in length and that it varies from almost nothing to 10 feet in width. The vein strikes southeast on the basis of mapping by Gledhill (1927) and Moore (1931). Moore (1931, p.24) reported that left-lateral displacement of 60 feet occurs across the diabase dike near No.1 shaft. Moore (1931, p.24) was not convinced that the vein mapped east of the diabase dike as the Murphy vein was the same vein as mapped west of the dike. Moore (1931, p.24) reported that the better gold values occurred in the metavolcanic rocks rather than porphyry.

Bruce (1940) prepared a detailed report on the Murphy Mine property. Bruce (1940, p.44) reported the presence of a 40 foot wide band of contorted silica-hematite iron formation not observed by the author near the western end of the vein. Bruce (1940, p.45) described the vein as being more than 2000 feet in length, strikes east to north 65|W and dips 70 to 80|S. Bruce (1940, p.45) reported left-lateral offset across the diabase dike as being 75 feet rather than the 60 feet mentioned by Moore (1931) and thus agrees with Collins and Quirke (1926) and MacLeod and Cowie (1926). The vein is variable in width varying from 1 to 10 feet and may contain horsts of wall rock (Bruce 1940, p.45). Bruce (1940, p.45) observed that quartz is the dominant vein material where the vein cuts metavolcanic rocks and carbonate is the dominant vein material where the vein cuts the porphyries. As previously stated by the author, Bruce (1940, p.45) found the vein to be low in sulphide content which contrasts with up to 20% reported by Studemeister (1987, p.181).

Bruce (1940, p.46) analyzed the vein carbonate and concluded that it was ankerite.

Bruce (1940, p.46) recognized two ages of vein quartz which he interpreted as later than the carbonate. Bruce (1940, p.46) reported the older quartz to be milky and glassy and the younger to be grey in colour and containing needles of tourmaline. Bruce (1940, p.46) reported the grey vein quartz cuts both the carbonate and milky vein quartz. The description of the two ages of vein quartz is at variance to the observations previously cited above by the author.

Bruce (1940, p.46) interpreted the gold to result from late filling of fractures within both quartz and carbonate within the vein. This fracture filled nature of the gold has been observed by the author on several small pieces of visible gold found on the mine dump. The nature of the fluid depositing the gold is unknown.

Bruce (1940, p.46) reported that the vein walls contain veinlets of quartz and carbonate, feldspars in the porphyries are sericitized and minor tourmaline and pyrite have been introduced.

Keeler (1940, p.19) classified the diabase dike west of No.1 shaft as an olivine diabase. This identification was not confirmed by the present mapping. The vein description of Keeler (1940, p.26-27) is similar if not identical to that of Bruce (1940) under whom he was employed. At a place called the East pit, presumably the open cut immediately east of No.1 shaft, Keeler (1940, p.27, p.36) identified talc, green serpentine and possible of pyrophyllite. Covellite as an alteration of bornite was reported by Keeler (1940, p.28). Keeler (1940, p.29) reported the vein paragenesis to be ankerite, white quartz, grey quartz, tourmaline, pyrite, pyrrhotite, chalcopyrite, sphalerite, bornite and gold.

Keeler (1940, p.33) mentioned bleaching of the vein wall up to 8 inches from the vein and concluded that silicification was the dominant alteration. He recognized carbonate alteration, sericitization and tourmaline and pyrite introduction. Keeler (1940, p.33-34) indicated silicification of the vein walls was more prominent in the porphyry and carbonate alteration was more prominent in the metavolcanic rocks.

Keeler (1940, p.35-36) concluded that the Murphy vein was a hydrothermal vein within a schist (shear) zone within porphyries and metavolcanic rocks. Keeler (1940, p.36) considered the vein to be related to the Gutcher Lake Stock.

A series of chip samples were collected from trenches east of the No.1 shaft by members of the field party. Four trenches were sampled with the best result being 0.04 ounces Au per ton over a width of 10 feet with chips at 110 foot intervals (Geoscience Laboratories).

The mine has a recorded production of 2,450 ounces of gold and 351 ounces of silver from 23,211 tons giving an average grade of 0.11 ounces per ton (AFRO).

MURPHY CLAIMS

Upon discovery by T. Murphy, A.V.J. Selkirk and J. Perry became partners with Murphy (Burrows 1921, p.621, 1922, p.40, Thomson 1921, p.25D). Soon after the discovery the claims were examined by a A.R. Porter of Toronto. There is no record of work at this time but presumably sampling and trenching were completed.

GOUDREAU GOLD MINES LIMITED

The twelve claims staked by Mr. Murphy were sold to Goudreau Gold Mines Limited in 1922. The company started sinking two shafts approximately 500 feet apart along the vein. Between 1922 and 1926, the No.1 shaft was completed to a vertical depth of 400 feet and the No.2 shaft to a vertical depth of 200 feet (Sutherland 1923, 1924, 1926, 1927, MacLeod 1923a p.296). Approximately 2,571 feet of drifting was completed during this period (Sutherland 1926). The No.2 shaft is located 500 feet west of No.1 shaft which was driven on a 70| incline.

MacLeod (1923b, 1923c, 1923d) visited the mine during development and reported a vein width of 25 feet, however, assay data was unavailable to him.

In a summary report prepared by MacLeod (1925, p.5), the operations at the mine were clouded in secrecy and that he was prevented from sampling the workings. MacLeod (1925, p.5) also mentioned that no qualified mining engineer was employed at the property.

Underground operations continued until May 1926 when work ceased (Sutherland 1926).

After underground operations ceased surface exploration continued by the company and a 5 hole diamond drill program was completed. This drilling totalled 2,999 feet and is presumed to have been completed in 1927. The position of these holes is given in figure 39 but logs and data relating to these holes could not be located. No technical data of Goudreau Gold Mines Limited could be located.

NEW GOUDREAU GOLD MINES LIMITED

In 1928 the assets of Goudreau Gold Mines Limited were acquired by New Goudreau Gold Mines Limited (Canadian Mines Register of Dormant and Defunct Companies p.168).

The charter for New Goudreau Gold Mines Limited was cancelled in 1956 and there is no record of work having been completed by the company (Canadian Mines Register of Dormant and Defunct Companies p.166).

BENNETT - PACAUD MINES LIMITED

Sinclair (1931, p.67) reported that Bennett-Pacaud Mines Limited optioned the Murphy Mine from Goudreau Gold Mines Limited in 1930. The mine was dewatered between June and August 1930 and sublevels driven on the 130 and 160 foot horizons. The option holders completed an estimated 290 feet of drifting, raising, winzing and station cutting (Sinclair 1931, p.68). The company dropped its option on November 15, 1930 (Sinclair 1931, p.68). No records of this work could be located.

ALGOLD MINES LIMITED

In 1934, Algold Mines Limited was formed to take over the property of New Goudreau Mines Limited (Sinclair 1936, p.67). The property was described at this time as having two 70 inclined shafts of 425 and 200 feet with levels at 100, 200 and 400 feet and sublevels at 130 and 160 feet (Sinclair 1936, p.68). The company dewatered the mine and completed an additional 923 feet of raising, cross cutting and drifting (Sinclair 1936, p.68, 1937, p.78). The total amount of underground development is given by Sinclair (1937 p.78) as now totalling 3,863 feet.

In 1936, the company completed 586 feet of raising, drifting and cross cutting and cut one small stope (Sinclair 1938, p.93). In 1937, the company completed an additional 845 feet of drifting and raising (Sinclair 1939, p.84) and in 1938 an additional 344 feet of drifting was completed (Sinclair 1940, p.74). Sinclair (1940, p.74) gives the total drifting as 4,225 feet, crosscutting 885 feet and raising 525 feet. Operations on the property by Algold Mines Limited ceased in August 1938. In 1939 Algold Gold Mines Limited was succeeded by Amherst Gold Mines Limited (Canadian Mines Register of Dormant and Defunct Companies p.13). The records of Algold Mines Limited company could not be located. Robertson (1959, p.4) mentioned that Algold Mines Limited did complete some surface diamond drilling.

ERIE CANADIAN MINES LIMITED

In 1938, Erie Canadian Mines Limited examined the property but did not complete additional work (Burke 1938).

AMHERST GOLD MINES LIMITED

In 1939 Amherst Gold Mines Limited succeeded Algold Gold Mines Limited. There is no record of this company having completed work on the property. Amherst Gold Mines Limited was bankrupt in 1942 and in November 1960 its charter cancelled (Canadian Mines Register of Dormant ad Defunct Companies p.18; Canadian Mines Register of Dormant and Defunct Companies first supplement p. 9). While in possession of the property it granted an option to Norgold Mines Limited.

Wright (1939, p.5,6) prepared a report for Amherst Gold Mines Limited on the property recommending deep diamond drilling below the workings, geologic mapping and additional sampling. Wright (1939) mentioned that records of earlier sampling, drilling and development were incomplete or missing. Wright (1939, p.4) estimated that the mill used by the former Algold Mines Limited recovered only a maximum of 72% of the gold in the ore. The report by Wright (1939) formed the basis for additional work by Norgold Mines Limited.

Surface mapping by Wright (1939) is compiled on Figure 38.

NORGOLD MINES LIMITED

In 1940, Amherst Gold Mines Limited granted an option to Norgold Mines Limited (Bruce 1940 p.44). A report on the property by Flaherty (1940) mentioned the lack of technical data on the property and that the possibility exists that previous operators had extracted waste along with ore. He recommended bulk sampling and limited diamond drilling. The company took a 400 ton bulk sample which was shipped to the Noranda Smelter (Bruce 1940, p.44). A plan map prepared for Golden Algoma Mines Limited by C.P.

Robertson in 1959 indicates that bulk sampling took place on both levels and that the results were not encouraging. The Norgold sampling as it appears on the C.P. Robertson map is compiled in Table 18.

On the plan maps prepared by C.P. Robertson (1959, AFRO) it is noted that a series of drill holes labeled Flaherty hole 7 etc. existed. These holes were likely deep holes drilled below the workings which were recommended in an earlier report by Wright (1939 p.6). Wright (1939 p.6) recommended 4000 feet of drilling, however, since the records of Norgold Mines Limited could not be located it is not known how much drilling was completed or where it was done. A minimum of 7 holes is indicated on the plan of C.P. Robertson which was prepared for Golden Algoma Mines Limited (AFRO). Norgold Mines Limited dropped its option in the fall of 1940 (Flaherty 1940). Robertson (1959, p.5) stated that two deep drill holes were completed by Norgold Mines Limited below the workings with negative results.

OMAR GOLD MINES LIMITED

In 1944, Omar Gold Mines took over the former Amherst Gold Mines Limited property (Northern Miner Press December 7, 1944). There is no record of this company completing work on this property and its charter was cancelled in 1957 (Canadian Mines Register of Dormant and Defunct Companies, p.291). The claims reverted to the Algoma Central and Hudson Bay Railroad Company.

GOLDEN ALGOMA MINES LIMITED

In 1959, Golden Algoma Mines Limited obtained a 99 year lease of the former mine site from the Algoma Central and Hudson Bay Railway Company (AFRO). Halstead (1959b, p.4) recommended that the property be diamond drilled.

In 1959, the mine was dewatered and sampling began (Staff of Mines Inspection Branch 1961). In 1959, 58 underground drill holes were completed totalling 5,444 feet (Halstead 1960b, p.10). This work is reported to have indicated a new ore zone 30 feet south of the 100-foot level drifts in holes 44 and 45 while drill holes 22, 23, 24, 26 and 26 indicated a parallel gold-bearing vein structure just west of No.1 shaft (Halstead 1960b, p.10). In 1959, Robertson (p.6) examined the property and noted that drill logs for the underground drilling were not prepared, that hole locations were not precisely known and a fire had destroyed the core shack and its contents. Some of these drill hole locations are indicated on a plan prepared by Mr. Robertson (AFRO) but hole numbers are missing indicating that records were not available to him. A plan map on file (AFRO) prepared by Mr. M.C. Halstead (1959) gave the location and numbers for most of the holes.

In 1960, the company completed at least a 15 hole surface diamond drilling program for which drill logs indicate a total footage of 5,459.0 feet (Riddell 1962, p.29, AFRO). The position of these drill holes is given in Figure 39 and tabulated assay values in excess of 0.10 ounce are given in Table 19. Plan maps on file (AFRO) indicate the company may have completed an additional 6 holes numbered 16 thru 21 inclusive. There is no record as to whether these holes were drilled, or proposed and never completed. By scaling from the plan map an additional 3340 feet of drilling may have been completed if holes 16 through 21 were completed.

Halstead (1960b p.10) estimated that 4,687 tons of ore at $4.70 per ton remain near the No.1 shaft; that 2,524 tons of ore at $17.85 per ton remain near the No.2 shaft above the 200 foot level and that 2,750 tons of ore may exist at the west open cut above the 200 foot level. All values are at $35.00 US per ounce.

The company dropped the property in 1962 or early 1963 (Canadian Mines Handbook 1963, p.126).

INTERNATIONAL CORONA RESOURCES LIMITED

In 1987, the Murphy Mine property was part of the holdings of International Corona Resources Limited. The old surface trenches had been cleaned out in 1985 and a base line cut across the property. The results of this work are not available.

PAQUETTE GROUP

Gledhill (1927, p.71) mentioned the presence of a quartz vein on a group of claims approximately 2 miles northwest of Murphy Lake. The rocks are metavolcanic rocks intruded by porphyry. Gledhill (1927, p.71) did not confirm the presence of gold.

PORTER-PREMIER OCCURRENCE (10)

Gledhill (1927, p.71) first described the Porter-Premier occurrence as a quartz vein within a shear zone in granodiorite. The walls of the vein were described as sericite schist with pyrite and tourmaline (Gledhill 1927, p.21). Gledhill (1927, p.71) described the vein as containing pyrite, chalcopyrite and sphalerite which trends east and dips north at 70|. At the time of his examination a 23 foot test pit had been sunk and the vein stripped for 225 feet (Gledhill 1927, p.71). Gledhill (1927, p.71) reported the presence of visible gold, particularly in the wall of the veins and that the vein lies on strike with the Farquhar vein to the east.

Studemeister (1982, p.175) reported the occurrence to consist of 4 parallel quartz-carbonate veins cutting the south margin of the Gutcher Lake Stock. The vein attitude is that described by Gledhill (1927) and the vein width is described as 2 m

(Studemeister 1927, p.175).

Studemeister (1982, p.175) described the veins as comprising massive quartz carbonate aggregates with up to 30% pyrite enveloped by a fine-grained leucocratic pyrite - albite - chlorite - ankerite - calcite - white mica - quartz schist. Studemeister (1982, p.175) reported the presence of sphene in the vein.

Studemeister (1982, p.176) described the veins as enveloped in schistose trondhjemite up to 2 m from the vein. The transition from schistose trondhjemite next to the vein to massive equigranular trondhjemite is gradual over the approximate 2 m width (Studemeister 1982, p.176). The schistose trondhjemite is cut by quartz-carbonate veinlets (Studemeister 1982, p.176).

On the basis of field examination, Studemeister (1982, p. 181) described the wall rock alteration as being from leucocratic quartz-feldspar trondhjemite to leucocratic quartz-feldspar trondhjemite to leucocratic pyrite-albite-chlorite - white mica - carbonate - quartz rock. Mineral alteration increases towards the vein (Studemeister 1982, p.181). The reader should refer to Studemeister (1982 p.17-181) for more detailed description of the rocks found at the Porter-Premier Occurrence. The showing was not visited by the field party.

RAND NO.2 IRON RANGE (11)

The Rand No.2 Iron Range was staked sometime prior to 1915 by Mr. J.W. Morrison and is also known as the Morrison No.2 Iron Range (Collins 1918, p.23E; Collins and Quirke 1926, p.103). The Rand No.2 Iron Range consists of two parallel bands of iron formation separated by approximately 170 m. The eastern limits of the range is defined by the McVeigh Creek Fault and the western limit is determined by a diabase-filled fault immediately west of Round Lake (local name, Figure 40. A narrow band of intermediate to felsic metavolcanic rocks occurs below the north band and the southern band lies directly on a thick section of intermediate to felsic metavolcanic rocks. Pillow structures on the north side of both bands indicate a north-facing stratigraphy. The rocks above and below the iron formation are pervasively soaked with carbonate and chloritoid porphyroblasts are abundant in the felsic and mafic rocks below and above the iron formation. The iron range has been left-laterally faulted in several places and these faults are occupied by diabase dikes. A few small quartz-feldspar porphyry dike intrusions have been noted in the area. The Rand No.2 Iron Range is a typical Michipicoten Iron Formation with siderite at the stratigraphic bottom followed by pyrite and chert up-section.

The author considers both bands of iron formation to be one and the same with the north band being thrust up over the south band due to low angle strike-slip faulting. This style of movement is thought by the author to give rise to the complex folding and faulting of the iron formation east of Goudreau. In this proposed model, the east end of the south band would correlate with the west end of the north band. The east end of the north band likely correlates with the Rand No.1 Iron Range at Goudreau on the east side of the McVeigh Creek Fault. The east end of the north band of the Rand No.2 Iron Range is offset 1900 m to the south from the Rand No.1 Iron Range across the McVeigh Creek Fault. To the west, the Rand No.2 Iron Range is faulted in several places but ultimately joins with the Reau-Mary Lakes Iron Range in adjoining Corbiere Township.

Trenching along the southern band by Superior Acid and Iron Limited has exposed thick sections of relatively massive pyrite and siderite along the south side of the iron range. Fifteen samples of sulphide facies iron formation were taken for gold analysis by the mapping party from the various trenches. One sample returned 0.01 ounces Au per ton and all others were lower in gold content (Geoscience Laboratories).

Collins and Quirke (1926, p.103, 104) reported the iron formation to dip 60 to 75|N and that the southern band is the most important economically. The southern band is reported by them to be 130 to 250 feet wide, 3800 feet long and to contain a pyrite layer 12 to 50 feet thick (average 30 feet). The pyrite is reported by them to vary between 27.92 and 43.65% sulphur, averaging 37.0% (Collins and Quirke 1926, p.105). Collins and Quirke (1926, p.105) described the pyrite as granular and mixed with siderite.

Collins and Quirke (1926, p. 105) reported the presence of siderite below the pyrite that varies from 6 to 60 feet, average 20 feet, in thickness. This siderite band was reported to be 2000 feet long extending from the centre of former claim AC 15 eastward (Collins and Quirke (1926, p. 105). Collins and Quirke (1926, p.105) reported the siderite to contain 30 to 35% iron.

Hawley (1942a) examined the Rand No.2 Iron Range and proposed a replacement origin for the siderite and pyrite deposits. The theories of Hawley (1942a) have been previously discussed (Sage 1987a).

In 1951, Richter (1952) examined the Rand No.2 Iron Range for Jalore Mining Company. The author independently concluded the north and south bands were likely faulted segments of the same iron range, however Richter (1952, p.48) had previously reached the same conclusion.

The south band is described by Richter (1952, p.48) as being 5,145 feet long, 50 to 100 feet wide and to contain a pyrite band averaging 50 feet wide in its Central and Tunnel sections (Figure 39). Siderite is reported by him to be present only in the central section and this unit averages 45 feet in thickness and contains calcium and magnesium carbonate (dolomite) in addition to siderite (Richter 1952, p.48).

The north band is less than 1000 feet in length, rarely greater than 50 feet wide and composed of a mixture of pyrite, chert and minor siderite (Richter 1952, p.49). Richter (1952, p.49) suggested the western end of the Rand No.2 Iron Range may correlate with the Cline Lake Iron Range.

Oudkerk (1983) collected chloritoid bearing core samples from drill core abandoned at the site by Superior Acid and Iron Limited. Oudkerk (1983) proposed that the Rand No.2 Iron Range originated from convecting fluids that continued to convect after the iron formation was capped by intermediate to mafic metavolcanic rocks of cycle two. This convection altered the underlying intermediate to felsic metavolcanic rocks and the overlying intermediate to mafic metavolcanic rocks giving rise to a rock composition that permitted the development of chloritoid porphyroblasts under greenschist facies conditions of regional metamorphism.

MORRISON

In 1915 and 1916, the Rand No.2 Iron Range was trenched and diamond drilled (Collins 1918, p.23E; Collins and Quirke 1926, p.104). Diamond drilling at this time consisted of 18 holes for a total of 2,917.5 feet. All holes except 17 and 18 were completed on the south band. A tabulated of existing drill logs for this period of time did not confirm the 4,470 feet of drilling cited by Collins and Quirke (1926, p.104). The drilling may have been done by Nichols Chemical Company. The drilling is tabulated in Table 20.

RAND CONSOLIDATED MINES LIMITED

In 1920, the property was sold to Rand Consolidated Mines Limited. This company started driving an adit on the south band in 1920 which ultimately reached approximately 168 feet (Collins and Quirke 1926, p.105; Hawley 1942b, p.12). The company may have compiled previous records, but there is no record of additional work by the company.

ALDERMAC COPPER CORPORATION LIMITED

In 1941 Aldermac Copper Corporation Limited controlled the property and a brief report by Hawley (1941, p.5, 6) recommended a magnetometer survey over the property. The company deepened hole 15 from 89.5 to 187 feet and drilled an additional 10 diamond drill holes numbered 19 through 28 inclusive (Hawley 1942b, p.14). This drilling totalled 4,218 feet with holes 19 thru 24 located on the central section of the south band and holes 25 thru 28 on the tunnel section of the north band of iron formation (Hawley 1942b, p.14; see Figure 40). Table 21 gives the grade and tonnage figures for pyrite ore and siderite ore that were calculated by Hawley (1942b, p.22).

Hawley (1942b, p.23, 24) reported the carbonate unit to average 41 feet thick and contain 56.1% siderite which upon sintering would give a product with 39.75% iron Hawley (1942b, p.24) considered the tonnage of siderite too small and grade too low to permit it to be used as a source of iron.

IRUSGO CONSOLIDATED MINES LIMITED

In 1964, IRSUGO Consolidated Mines Limited owned the property which was visited at that time by Mr. D.E. Smith for Algoma Steel Corporation Limited (Smith 1964). Smith (1964, p.3) concurred with the conclusions of Hawley (1942b). There is no record of work having been completed by IRSUGO Consolidated Mines Limited.

SUPERIOR ACID AND IRON LIMITED

In 1968 the property was under control of Superior Iron and Acid Limited after optioning from IRUSGO Consolidated Mines Limited (Canadian Mines Handbook 1970, 1971, p. 343). Records for the work completed by Superior Acid and Iron Limited were presented to the survey by Mr. I. Thompson of Duncan R. Derry Limited and Mr. Donald W. Esson, Consulting Geologist. Using existing records Dolmage-Campbell and Associates Limited (1968, p. 3) Limited estimated the presence of 7,150,000 tons of 49.9% pyrite above the level of the Algoma Central and Hudson Bay Railway bed and 11,010,000 tons of geologically inferred tonnage of similar grade 300 feet below railroad bed and in non-drilled portions of the iron formation. They recommended confirmation of underground drifting and more surface drilling (Dolmage-Campbell and Associates Limited (1968, p. 3).

Esson (1968) prepared a very brief report on the property prior to a 18 hole diamond drill program supervised by Duncan R. Derry Limited. The company completed 5,322 feet of drilling and recalculated the pyrite reserves of the Rand No. 2 Iron Range (Middleton and Thompson 1969, p. 4-3). The reserves calculated by Middleton and Thompson (1969) are given in Table 22. Ground electromagnetic surveys were completed over portions of the property but details are not available (Middleton and Thompson 1969, p. 4-4). The report by Middleton and Thompson (1969) deals with many aspects of mining and commercial exploitation of the Rand No.2 Iron Range and the reader should refer to that report for details. Hemstock and Coyne (1969) and Atkins (1969) have also prepared detailed reports on the mining, benefication and costs of mining Rand No.2 Iron Range pyrite. These reports are on file in Toronto (AFRO).

Work on the Rand No.2 Iron Range continued into 1969 and an additional 39 diamond drill holes were completed for an additional 16,820 feet of drilling Esson (1969, p. 21-24). In this 1969 series of holes numbers 29, 32, 37 and 41 were not drilled. This work resulted in new grade and tonnage calculations which are given in Table 23.

In 1969, an underground program was started and an adit was driven into the north band. As scaled from plan maps this drifting totalled approximately 1235 feet and terminated approximately 400 feet east of the west end of the north band. From this drift 2,086 feet of EXT diamond drilling in 54 holes was completed (Esson 1970, p.2). This work decreased the tonnage in area explored from 380,000 to 270,000 tons with a slight increase in grade to 29% sulphur. The work showed more variability in the ore than surface drilling indicated and additional work was recommended Esson (1970, p. 6-9). No additional work was reported and the option was dropped in approximately 1971. Cross sections prepared by Mr. Esson for Superior Acid and Iron Limited indicate an iron formation dipping approximately 70| north (AFRO).

Table 19 gives a summary of diamond drilling to date and Figure 40 is a compilation of previous drilling, geology and development on the property. Tables 21, 22 and 23 illustrate the changing tonnage estimates with time resulting from continued diamond drill testing.

REALM MINING CORPORATION LIMITED

The Realm Mining Corporation Limited completed a magnetometer survey on a group of claims between Perry and Reau Lakes in 1959 (Zurowski 1959). No additional work has been reported.

ROBINSON CLAIMS

J.R. Robinson held claims on a quartz vein cutting mafic metavolcanic rocks west of an unnamed pond 1.2 km southeast of Selkirk Lake. Some pitting and trenching of the vein has been done and Hollinger Consolidated Gold Mines Limited collected 17 samples from the showing (AFRO). Of the 17 samples 16 returned traces of gold and one assayed 0.08 ounces per ton (AFRO). No attempt was made by the mapping party to relocate the vein.

RUTLEDGE IRON RANGE (42)

Goodwin (1953b, p.30) described an iron formation in northwestern Abotossaway Township. This iron range was geophysically inferred during the present mapping for outcrop could not be located. Goodwin (1953b, p.30) indicated outcrop does occur in the centre of the range for 300 to 400 feet and indicates a width of 110 feet. The Rutledge Iron Range is reported to consist of fine granular chert and magnetite (Goodwin 1953b, p.30). Goodwin (1953b, p.30) reported that assay results on a chip sample over the width of the formation were 22.85% iron, 62.60% silica, 0.010% sulphur and 0.037% phosphorus. On the basis of geophysics this iron range has a strike length of approximately 1525 m.

To the west and across the Marsdon Fault, this range would correlate with the North Evans Creek Iron Range. To the east geophysics indicates gaps in the iron range but that it is traceable across northwestern Abotossaway Township into southeastern Dunphy Township. In Dunphy Township and eastward across the McVeigh Creek Fault, the range is known as the Dreany Iron Range.

UNION MINIERE EXPLORATIONS AND MINING CORPORATION LIMITED (12)

As a follow up to a regional electromagnetic and magnetic survey the Union Miniere Explorations and Mining Corporation Limited drilled one diamond drill hole on an electromagnetic anomaly near Byron Lake (AFRO, Toronto). This was their anomaly Wa-2-43 and their hole Wa-15. Several bands of pyrite and pyrrhotite were encountered in the hole and disseminated sulphides were abundant. The principal sections of sulphide mineralization were from 25.0 to 31.5 feet, 66.0 to 79.8 feet, 107.0 to 158.5 feet and 197.0 to 221.0 feet (AFRO). The section from 164.0 to 197.0 is reported to be 90% sulphide on the drill log. The host rocks are described as mafic volcanic rocks and felsic tuffs (AFRO). The hole reached a total depth of 263.0 feet (AFRO). Assays were not reported (AFRO). On the basis of regional mapping the drilling likely encountered segments of Michipicoten iron formation along the mafic - felsic metavolcanic contact. The reader should refer to the Reau-Mary Lakes Iron Range in the adjacent township for more data.

CORBIERE TOWNSHIP

Numerous samples of altered rock and iron formation were taken for assay during the mapping this township.

One sample of chert, siderite, pyrite iron formation from the East Brooks Iron Range returned 0.02 ounces Au per ton.

A sample of a sulphide clast in a highly carbonatized mafic breccia south of Parks Lake collected by the author also returned 0.02 ounces Au per ton. The location of these two gold-bearing samples is indicated on the accompanying compilation maps for Corbiere Township.

BANNER GOLD MINES LIMITED

Banner Gold Mines Limited held claims in the township in 1936. The precise location of these claims is unknown and no work was recorded (AFRO, Toronto).

BARTLETT (BRITANNIA) IRON RANGE (13)

The Bartlett Iron Range was discovered and staked by Mr. James Bartlett in the summer of 1911 in cooperation with Mr. W.M. Goodwin for the Algoma Steel Corporation (Collins and Quirke 1926, p.91). The Bartlett Iron Range is terminated in the east by the Marsden Fault which juxtaposed granite next to the iron formation. To the west, the Bartlett Iron Range is continuous with the Josephine Iron Range. The Bartlett Iron Range is that portion of the iron formation underlying claims AC 290, 291, 292, 293, 294, 295 and 296 (Figure 41). Claim AC 289 and those to the west are part of the Josephine Iron Range. Collectively this portion of the Michipicoten iron range is often referred to as the Josephine-Bartlett Iron Range and is a typical Michipicoten-type iron formation occurring at the top of cycle one intermediate to felsic metavolcanic rocks and at the base of cycle two intermediate to mafic metavolcanic rocks. It consists of siderite at the stratigraphic bottom grading upward through pyrite and chert. The stratigraphic section faces north, is steeply dipping and strike-slip faulting related to the Magpie River Fault occurs close to and along the top of the iron formation. The curvilinear band of iron formation forms a prominent topographic ridge in the southern part of Corbiere Township. On the basis of plan maps prepared by the Algoma Steel Corporation the iron range is approximately 8500 feet long from the west boundary of claim AC 290 to the Marsden Fault (AFRO). The same plans show a iron range of approximately 375 feet thick with a maximum width of 600 near Bartlett Lake after which it tapers rapidly eastward until truncated by the Marsden Fault.

Collins (1918) mentioned this iron range and Collins and Quirke (1926, p.91, 92) prepared a geological description.

Collins and Quirke (1926, p.91) estimated a strike length of 3 2/3 miles which must include part of the Josephine Iron Range. The Bartlett Iron Range was estimated as 80 to 150 feet thick on the eastern claims and 250 to 550 feet thick throughout the remainder of its length (Collins and Quirke 1926, p.91). In outcrop the iron range is two thirds white chert and a relatively continuous band of siderite occurs on the south side (Collins and Quirke 1926, p.91). Collins and Quirke (1926, p.91) mentions felsic volcanic rocks above the Bartlett Iron Range but their presence was not noted by the field party. The metasedimentary rocks north of Siderite Lake may have been interpreted by them as felsic volcanic rocks.

ALGOMA STEEL CORPORATION LIMITED

Shortly after discovery in 1911 trenching of the iron range at 100 foot spacing was undertaken (Hasselbring 1911, 1912a, Goodwin 1912b). This surface work uncovered a siderite zone 1650 feet long and 50 feet thick containing an estimated 40.72% iron, 4.61% silica, 3.54% sulphur and 0.008% phosphorous (Hasselbring 1912a). From December 1911 to September 1912 four diamond drill holes were completed for a total of 3817.5 feet (Hasselbring 1912a). This drilling confirmed the presence of siderite.

In 1916a, Leith (p.2, 3) examined the existing records and on the basis of eight trenches and three of the four drill holes estimated the presence of 241,944 tons of siderite. Due to high sulphur content Leith (1916a, p.3) did not consider the siderite to be of economic interest.

Work on the Bartlett Iron Range was suspended until 1946 when a major diamond drill program was undertaken by Algoma Steel Corporation Limited. Zodrow (1963) indicated that 102 diamond drill holes were completed on the property 30 of which were X-ray holes completed between sections 23 and 27 (see Figure 40). Records exist for the completion of 111 holes, 110 of which have a total of 36,646.5 with the records for one hole missing (AFRO). In addition to the 111 diamond drill holes the company completed a deep hole totalling 2,829.0 feet. Siderite was intersected at 2714 feet and the hole was continued into iron formation until it was terminated (AFRO). Between the depth of 2714 and 2810 feet assays on the drill log indicate an average grade of 41.02% iron, 7.55% silica, 17.48% sulphur, 1.75% manganese and loss on ignition of 26.72% (AFRO). It was estimated that a sinter containing 58.36% iron could be produced from the siderite.

Drilling of this deep hole started at 61.5° at surface but the hole flattened to 4.5° at a depth of 2810 feet (AFRO). Plotting the angles and lengths as a cross section suggests that the siderite was intersected at an vertical depth of approximately 2120 feet and that the contact of the siderite with the underlying tuffs lies north of its position at surface. The deep hole confirms the presence of siderite at depth and indicates the iron formation dips steeply north, at approximately 80°.

Records (AFRO) indicate that the siderite portion of the iron formation was divided into 4 blocks labelled A thru D. The tonnages in the various zones are given in Table 24 and the position of the proposed ore bodies are given in Figure 41.

In approximately 1958 an airborne magnetic survey was completed over the Bartlett Iron Range and some ground traverses with dip needle were completed (Goodwin 1958b). There is no record of additional work on the iron range. A reserve figure of 30 million tons is given in the Canadian Mines Handbook (1967-1968, p.23) for the Bartlett Iron Range. The total sum of all drilling on the iron range since 1912 is 43,293.0 feet.

BIG LAKE IRON RANGE (14)

The Big Lake Iron Range extends from the east side of Big Lake to a small unnamed lake southeast of Big Lake and was discovered in 1950 by prospectors for Jalore Mining Company Limited (Richter 1952, p.44). The dominant lithology is intermediate to mafic massive and pillowed metavolcanic rocks with small thin units of intermediate to felsic metavolcanic rocks in the centre of the range and southeast of Big Lake. The intermediate to felsic metavolcanic rocks are principally tuff, sericite schist and lapilli tuff. In spite of generally good outcrop the iron formation is present as subdued, deeply weathered, siliceous gossan. The presence of the gossan makes tracing of the unit relatively easy. The rocks enclosing the iron range are pervasively soaked with carbonate and very schistose. The mafic rocks are often so heavily carbonated that their light weathering characteristics permits confusion with some felsic rocks. The author considers the Big Lake Iron Range to be related to the Cline Lake Iron Range similar to the relationship of the north and south bands found at the Rand No.2 Iron Range. In this model the iron ranges are the same with one band (Big Lake) being thrust over the other (Cline Lake) due to low angle shearing and then subsequently folded to form the Alden Lake anticline. If the stacked iron ranges east of Goudreau were folded and sheared in a similar manner a similar pattern would result. Siderite is reported in drill holes BL-3 and -13 but siderite in general is rare (AFRO). Siderite flows are mentioned on drill logs but the author interprets these sections to be highly carbonated metavolcanic rocks and not true siderite iron formation. The drill logs indicate an abundance of pyrite and pyrrhotite on the northeast side of the range becoming more cherty to the south (AFRO). Graphitic schist was mentioned in association with the iron formation in drill holes C5, C6 and C7. The facies distribution in the iron formation suggests it faces southwest which is in agreement with folding data based on pillow shape.

In addition to the abundance of carbonate in the metavolcanic rocks chloritoid porphyroblasts are common within both felsic and mafic metavolcanic rocks within the area enclosing the iron formation. Richter (1952, p.44, 54) indicated that the Big Lake Iron Range is 1600 feet long but mapping and interpretation by this field party suggests a length of approximately 5300 feet with possibly some necking and pinchouts. Richter (1952, p.44) estimated an average width of 75 feet which appears reasonable. The iron formation is curvilinear, northwest-southeast striking and subvertical in dip. Airborne electromagnetic surveys flown by International Corona Resources Limited supports the greater strike length and that the Big Lake Iron Range may be correlative with the Sheldon Lake Iron Range (AFRO). Richter (1952, p.46) correlated the Big Lake Iron Range across the Marsden Fault with the Central Brooks Iron Range. The author correlates the north end of the Big Lake Iron Range with Reau-Mary Lakes Iron Range and its south end with the Sheldon Lake Iron Range. Young (1951, p.7) correlated the Big Lake Iron Range with the Sheldon Lake Iron Range but proposed an intervening fault which this field party did not locate.

Sirola (1953, p.6, 7) observed the iron formation was commonly brecciated and considered the pyrite ore bodies to be later than the iron formation (chert) and emplaced after deformation.

JALORE MINING COMPANY LIMITED

The Big Lake Iron Range was discovered in 1950 by prospectors for Jalore Mining Company Limited. The company completed a grid over the iron formation and geologically mapped the range. The company drilled 14 short diamond drill holes totalling 1397.1 feet (AFRO), see Figure 41. Zinc mineralization was reported to have been encountered in hole BL-1 between 57 feet 3 inches and 112 feet 3 inches but the mineral containing the zinc could not be identified (AFRO).

It was estimated at this time that 654,000 tons of pyrite to a depth of 100 feet were present grading 31.00% sulphur, 38.42% iron and 7.15% silica (Sirola 1953, p.4).

CANDELA DEVELOPMENT COMPANY LIMITED

Candela Development company a wholly owned subsidiary of the Freeport Sulphur company entered into an agreement with Jalore Mining Company Limited in May 1953 to undertake further development of the Big Lake Iron Range. Candela Development Company completed an additional 11 diamond drill holes. This drilling totalled 4112.4 feet (AFRO; Figure 42). This drilling outlined two pyrite orebodies known as No.1 and No.2 (see Figure 41; Sirola 1953, p.8, 9). The No.1 orebody is estimated to contain 302,150 tons per 100 foot of depth grading 33.60% sulphur, 36.60% iron and 9.95% silica (Sirola 1953, p.8).

The No.2 pyrite orebody is estimated at 384,400 tons per 100 foot of depth grading 28.50% sulphur, 40.70% iron and 5.42% silica (Sirola 1953, p.9). Sirola (1953 p.9, 10) reported intersections of massive pyrite on three other drill cross sections through the range indicating the probability of additional material. Sirola (1953, p.11) estimated the probability of 462,420 tons of additional material to 300 feet. If all tonnages are calculated to a depth of 300 feet and possible ore included, Sirola (1953, p.11) estimated that 2,522,070 tons of pyrite ore is present.

JOGRAN MINES LIMITED

In 1966, Jogran Mines Limited acquired title to Township 27, Range 26 and using previous work of by Jalore Mining Company Limited and Candela Development Company attempted to promote development of the pyrite orebodies as a source of sulphur (Jeckell 1967). There is no record of work having been completed by the company.

GETTY MINES LIMITED

In 1972, Getty Mines Limited undertook a program of exploration for base metals in the area. They purchased the airborne magnetic and electromagnetic maps of Acme Gas and Oil Limited (Bryant and White 1973, p.19) and completed some airborne geophysical surveys of their own. Interest in the Big Lake Iron Range was stimulated by the report of 1.6% Zn in hole BL-1 over 54 feet of drill core (Bryant and White 1973, p.19). The company completed a geologic map over the Big Lake, Cline Lake and Sheldon Lake Iron Ranges and soil geochemical surveys for copper and zinc (Bryant and White 1973, p.18-28). The company completed one diamond drill hole No.G0-1 (see Figure 41) totalling 213.5 feet (AFRO). This hole was drilled approximately 200 feet south of hole BL-1 reported to contain high zinc (Figure 41). Assays accompanying the drill log of the hole give trace of copper, trace to 0.61% Zn and nil to trace of gold and silver (AFRO). The Big Lake Iron Range is not unusually enriched in either base or precious metals when compared to any other Michipicoten type iron formation.

CENTRAL BROOKS IRON RANGE (15)

The Central Brooks Iron Range lies in central Corbiere Township. The time of actual discovery is unknown, but it was being actively prospected in 1912. The Central Brooks Iron Range forms a ridge up to 250 feet high that decreases in height eastward to approximately 15 feet above local lake level (Graham 1950, p.3). Along the north side of the iron range sericite schists and intermediate to felsic tuffs are present. South of the iron range the rocks are intermediate to mafic massive and pillowed metavolcanic rocks. On the basis of pillow shape, the stratigraphy faces south. Mapping and diamond drilling by Jalore Mining Company Limited indicates the presence of siliceous siderite along the north side of the iron range and cherty iron formation to the south. The distribution of facies of iron formation also supports a south-facing stratigraphy. The Central Brooks Iron Range is a typical Michipicoten Iron formation that occurs between the cycle one intermediate to felsic metavolcanic rocks and the overlying cycle two intermediate to mafic metavolcanic rocks. The range is subvertically dipping and cut off to the east by the Marsden Fault. To the west, the Central Brooks Iron Range pinches out at an unnamed lake. The strike length is slightly in excess of 5,000 feet. Richter (1952, p.54) stated the Central Brooks Iron Range is 5000 feet long and averages 200 wide. The maps of Jalore Mining Company Limited suggest a greater width (Figure 43). A diabase dike occupies the Marsden Fault at the east end of the iron range and diabase dikes cut the west end of the iron range. Offset is not apparent across the diabase dikes cutting the west end of the range. The metavolcanic rocks enclosing the iron range are schistose, carbonated and chloritoid porphyroblasts are locally common.

The first brief description of the Brooks Iron Ranges was by

Ontario Iron Ore Committee (1924, p.194) which did not subdivide the various iron ranges then known as the Brooks ranges.

Collins and Quirke (1926, p.93, 94) prepared a brief description of the Brooks Iron Ranges and numbered them 1 thru 3.

The author is uncertain which number applies to which of the Brooks ranges but from the description of the ranges the No.2 range is equivalent to the Central Brooks (Collins and Quirke 1926, p.93, 94; McKee 1950, p.2).

Richter (1952, p.41) described the east end of the Central Brooks Iron Range as occurring 200 feet north of the west end of the East Brooks Iron Range which lies east of the Marsden Fault. Richter (1952, p.41) described the range as being 200 feet thick at its east end and 600 feet thick at its western end. Richter (1952, p.71) reported that siderite occurs on the north side of the range and that pillow shapes south of the range indicate a south-facing stratigraphy. He proposed a synclinal axis between the south-facing Central Brooks Iron Range and the north-facing Josephine-Bartlett Iron Range 3.2 km to the south. The opposing stratigraphy occurs across the Magpie River Fault and thus a fold axis is not present but a fault. Richter (1952, p.42) correlated the Central Brooks Iron Range with the Big Lake Iron Range, however, the author prefers to correlate it with the east end of the Bartlett Iron Range. The Central Brooks Iron Range stratigraphy has been folded and faulted above the Josephine-Bartlett iron ranges. At the west end of the Central Brooks Iron Range a split in the iron range occurs for a distance of 1600 feet (Graham 1950, p.10; Webber 1950a, p.2; McKee 1950, p.5). The rock between the two appendages of iron formation has been described as carbonate rock and diabase (Webber 1950, p.2; Graham 1950, p.10). The simplified geology reported by Jalore Mining Company Limited is given in Figure 42.

The iron formation has been described as massive to brecciated silica with minor amounts of magnetite, pyrite and siderite (Graham 1950, p.11; Weber 1950a, p.2; McKee 1950, p.5). Local areas of siliceous siderite are found along the north side of the iron range and within the iron formation (McKee 1950, p.5). The position of the siderite lenses is illustrated in Figure 43.

LAKE SUPERIOR CORPORATION (ALGOMA STEEL CORPORATION LIMITED)

In 1912, E.L. Goodwin (1912a) prepared geological maps of the Brooks Iron Ranges and completed trenching and sampling (McKee 1950, p.2). The detailed results of this work is unavailable, however, Graham (1950, p.2) stated that the original maps were of good quality.

Goodwin (1912a, p.2) reported that 14 trenches were completed and two small bodies of siderite were identified. One body is 400 feet long by 30 feet wide and the second is 100 feet long and 45 feet wide.

JALORE MINING COMPANY LIMITED

Starting in 1949, the Jalore Mining Company Limited undertook a program to evaluate the Central Brooks Iron Range. This work is described by Graham (1950), Webber (1950a), McKee (1950) and Richter (1951, 1952). The company completed 10 short diamond drill holes totalling 570.5 feet. Holes 6 and 7 were abandoned before encountering bedrock. The best intersection was hole CB-9 which cut 61 feet (at 45|) of siliceous siderite grading 26.60 Fe and 27.54 SiO_2 (McKee 1950, p.5). There is no record of work on the Central Brooks Iron Range subsequent to that of Jalore Mining Company Limited.

CLINE LAKE IRON RANGE (16)

The Cline Lake Iron Range is a poorly exposed Michipicoten-type iron range that occurs at the break between mafic and felsic volcanism of cycles one and two.

Precisely when the Cline Lake Iron Range was discovered is unknown, however the range was reported to have been rediscovered in the summer of 1951 by prospectors for Jalore Mining Company Limited (Richter 1951, p.46). However, Richards and Schmidt (1947, p.1) prepared a reconnaissance report on the iron range in 1947 so the iron range was known as early as 1947. The iron range was prospected by Mr. James Cline at some unknown earlier period who built a cabin at the south end of Finger Lake (Cline Lake) (Richards and Schmidt 1947, p.1).

Richter (1952, p.46) described the iron range as consisting of coarse pyrite disseminated in chert adjacent to and south of a banded chert horizon. Richter (1951, p.46) did not see siderite and pyrite in outcrop. The enclosing rocks were interpreted to be facing north (Richter 1952, p.47), however, mapping by this field party indicate they are south facing and that the iron range occurs on the west side of the Alden Lake anticline. Richter (1952, p.47) stated that the east end of the Cline Lake Iron range was terminated by a small dioritic stock which was not encountered by members of this mapping party. The Cline Lake Iron Range was correlated with the Rand No.2 Iron Range by Richter (1952, p.47). The author concurs with this possible correlation with the intervening Reau-Mary Lakes Iron Range lying between the two ranges. The south end of the Cline Lake Iron Range would correlate with the north end of the Big Lake Iron Range if the shearing and stacking took place before folding as proposed by the author. The Big Lake Iron Range would then correlate with the Sheldon Lake Iron Range. Richter (1952, p.55) stated the Cline Lake Iron Range is 2,000 feet long and 75 feet wide, Sirola (1953, p.30) estimates a length of 4600 feet and a width varying from 10 to 40 feet. Mapping by this field party and by Getty Mines Limited (AFRO) indicate that the greater strike length is more likely.

Richter (1952, p.47) stated the iron range dips steeply south to vertical and Sirola (1953, p.30) stated the range dips steeply north. The iron range appears to have a vertical to subvertical dip.

Bryant and White (1973, p.29) reported a 1 foot thick graphite lens on the north side of the iron range and that thin graphite, pyrite and magnetite bands occur throughout the formation. These graphite and magnetite bands were not observed by the field party.

CLINE, JAMES

Mr. James Cline completed extensive trenching along the iron range at some unknown date (Richards and Schmidt 1947, p.1).

JALORE MINING COMPANY LIMITED

The Jalore Mining Company Limited mapped the Cline Lake Iron Range (Sirola 1953, p.30). There is no record of the company completing additional work.

GETTY MINES LIMITED

Getty Mines Limited prepared a geological map of the Cline Lake Iron Range along with mapping of the Big Lake and Sheldon Lake iron ranges. In reports prepared by Getty Mines Limited, the Cline Lake Iron Formation is referred to as the northeast anomaly (Bryant and White 1973, p.29). The company completed soil geochemical surveys for copper and zinc over the iron range and a ground VLF-EM (Radem) survey (Bryant and White 1923, p.30-33).

Some chalcopyrite-bearing fractures were found and one analysis of 0.55% Cu and 0.64% Zi was reported by the company (Bryant and White 1973, p.30). Four geochemically anomalous zones were identified for zinc and to a lesser extent copper.

The company completed three diamond drill holes on the Cline Lake Iron Range (Holes GO-2, GO-3 and GO-4) totalling 590 feet. Assays for holes 2 and 3 were not reported (AFRO). For drill hole GO-4 Cu assays varied from 0.01 to 0.21% and Zi from 0.02 to 0.47% with only a trace of gold (AFRO). The assay results were discouraging and no further work was completed. The positions of the three drill holes completed on the Cline Lake Iron Range are indicated on the accompanying compilation map for Corbiere Township.

EAST BROOKS IRON RANGE (17)

The East Brooks Iron Range occurs in the southeast corner of Corbiere Township. To the south of the East Brooks Iron Range, intermediate to felsic quartz-feldspar crystal tuffs, sericite schists, feldspar crystal tuffs and bedded tuffs are interbedded with intermediate to mafic schists, flows and tuffs. North of the iron range lies a thick sequence of massive and pillowed intermediate to mafic metavolcanic rocks. On the basis of pillow shapes, the stratigraphy faces north. Mapping and diamond drilling by Jalore Mining Company Limited indicate the presence of siderite along the south side of the iron range which on the basis of distribution of iron formation facies also indicates a north-facing stratigraphy. Mapping indicates a subvertical dipping stratigraphy and a iron range approximately 4,000 feet long. Richter (1952, p.54) indicated the East Brook Iron Range is 4,000 feet long and averages 75 feet wide. The East Brooks Iron Range is a Michipicoten-type iron formation occurring at the break between cycle one and cycle two volcanism.

The first description of this iron range was prepared by Ontario Iron Ore Committee (1924, p.194) which lumped all the Brooks ranges into one. Collins and Quirke (1926, p.93) prepared a brief description of the East Brooks Iron Range in which it is referred to as Brooks No.1 (McKee 1950, p.2).

Richter (1952, p.40) reported the East Brook Iron Range to reach a maximum width of 250 feet and that it is separated into two parts by a small fault. This fault is not shown on the maps prepared by Jalore Mining Company Limited (see Figure 43). The siderite and pyrite zone underlies the chert, is highly variable in width and rarely exceeds 50 feet in thickness (Richter 1952, p.40).

The East Brooks Iron Range is reported by Richter (1952, p.41) to dip subvertically to steeply north.

The west limit of the East Brooks Iron Range is the Marsden Fault and the east end pinches out and disappears beneath a small lake (Figure 44).

The iron formation consists of massive to banded chert along the north side with a siderite-pyrite zone along the south side. The siderite-pyrite zone is highly variable in width along strike and locally pinches out (Figure 44). The rocks enclosing the East Brooks Iron Range are schistose and carbonated. Chloritoid porphyroblasts which are common at other iron ranges were not visually observed to be present within rocks enclosing the iron formation.

LAKE SUPERIOR CORPORATION (ALGOMA STEEL CORPORATION LIMITED)

In 1912, E.L. Goodwin (1912a) prepared geological maps of the Brooks Iron Ranges in conjunction with trenching and sampling. The detailed result of this work is unavailable.

Goodwin (1912a, p.1) described Range No.1 or East Brooks Iron Range as 80 to 170 feet wide, 3/4 mile long consisting of granular iron formation containing siderite and pyrite. He (Goodwin 1912a, p.2) stated that the range was trenched at 21 sites and that the ore consists of pyrite with a siderite gangue. It was not considered to be commercial.

It is known that Parcel 223X covering the western portion of the East Brooks Iron Range was granted to a Mr. John Gamble in 1891 (McKee 1950, p.1). This is seven years prior to discovery of the Helen Iron Range and 21 years prior to the presumed discovery of the East Brooks Iron Range by prospectors for the Lake Superior Corporation (Algoma Steel Corporation; McKee 1950, p.1).

JALORE MINING COMPANY LIMITED

The Jalore Mining Company Limited undertook a program of geologic mapping and sampling in 1950. This work is summarized by Graham (1950), McKee (1950) and Webber (1950b). Geological mapping was followed by a diamond drill program totalling 18 holes and 7,850.5 feet (AFRO). These hole locations are shown on Figure 43. The iron formation was divided into two sections identified as A and B (Taylor 1950, p.2). Section A occurs between the Marsden Fault and footage 2800 on the Jalore Mining Company Limited baseline. Taylor (1950, p.2) estimates a mineralized zone 2,075 feet long grading 26.26% iron, 27.61% silica and 8.26% sulphur.

Section B has a strike length of 825 feet between 3800 and 4600 feet along the Jalore Mining Company Limited base line (Taylor 1950, p.2). This zone has a grade of 39.87% iron, 11.88% silica and 11.05% sulphur (Taylor 1950, p.2). In zone A, Taylor (1950, p.2) estimated the presence of 1,351,142 tons and in Zone B, 312,500 tons. The combined tonnage is 1,663,642 tons grading 28.8% iron, 24.6% silica and 8.78% sulphur (Taylor 1950, p.2).

Taylor (1950, p.2) did not specify the width or depth used in his calculations.

The siderite-pyrite zone is reported to decrease in width with depth (Taylor 1950, p.3), however, siderite ore bodies at the Helen Iron Range pinch and swell in the vertical plane and deeper drilling may find the siderite-pyrite zone expanding. The low tonnage and inferior grade as a iron source discouraged the company from doing additional work. Drill logs for most of the drill holes could not be located but cross sections are available (AFRO).

An Arc spectrographic report on file (AFRO) indicates holes 1, 2 and 4 contain much copper. Exact concentrations of copper were not given.

Giguere (1969) estimated the grade as 30.66% iron over a width of 17.6 feet on the basis of drilling by Jalore Mining Company Limited. Giguere (1969) did not complete a tonnage calculation.

There is no record of additional work having been completed on this iron range.

EDWARDS GOLD OCCURRENCE (18)

The Edwards Gold Occurrence occurs approximately 0.4 km west of Edwards Lake (local name). The name of the individual who discovered gold on this property has been lost but in 1939 a Mr. Peter Edwards purchased the property from two Hawk Junction men who staked the property in 1937 (Hesse 1958, p.2; Yule 1983a, p.11).

The showing occurs in intermediate to mafic metavolcanic rocks that are massive and locally schistose. Local thin interbeds of tuff, feldspar crystal tuff and quartz-feldspar crystal tuff are present. The rocks at the showing are schistose, cut by quartz veins and locally massive pyrite and pyrrhotite is present. A thin unit of chert and sulphide facies iron formation occurs in the shear zone. At Edwards Lake numerous small irregular quartz feldspar porphyry intrusions are present marking the outer limits of granitic magmatism related to the Hawk Lake Granitic Complex. South of Edwards Lake two barren pyrite horizons were encountered in schistose intermediate to mafic metavolcanic rocks intruded by the quartz-feldspar porphyry intrusions. The rocks at the site are not as carbonated as the metavolcanic rocks and metasedimentary rocks within most of the township. The showing probably occurs in the outer fringe of thermal metamorphism related to the emplacement of the Hawk Lake Granitic Complex. Using trench maps (AFRO), a suite of samples were collected for assay (Figure 45, Table 25). The assay values indicate a close association of gold with sulphide facies iron formation. Within the current project these values were the best obtained from rocks mapped as iron formation. Considering the intensity of the shearing at the showing the iron formation is likely a favourable structural site for gold deposition and it probably did not originally contain significant gold values at the time of deposition but is secondary in origin. Yule (1983a, p.11) completed more work on the showing and classified the gold showing as occurring in an auriferous sulphide facies iron formation. The showing occurs on or very close to an airborne indicated conductive zone (Yule 1983a, p.12).

The shear zone is subvertical in dip and varies from 0.3 m to over 1 m in width. The sulphide facies iron formation is not exposed in all the trenches and may be a series of lenses, perhaps boudinaged due to shearing.

The property is reported to have produced 28 ounces of gold from 46 tons of ore (AFRO).

EDWARDS, PETER

Shortly after purchasing the property Mr. Edwards erected a small "Gibson" mill on the property to treat ore from pits (Hesse 1958, p.2). The ore was not free milling and little gold was recovered by amalgamation (Hesse 1958, p.2). Several small batches of concentrate were produced and one 10-ton bulk sample assaying 0.3015 ounces Au per ton is reported to have been shipped to Noranda (Hesse 1958, p.2). The remains of the 5 ton "Gibson" mill can still be seen at the southwest corner of Edwards Lake (Plate 15). Mr. Edwards apparently completed two diamond drill holes on the property in 1941 (Hesse 1958). Records for these holes are missing; their location is given in Figure 45.

Assay sheets attached to the report by Hesse (1958) presumably obtained from Mr. Peter Edwards show numerous interesting gold values to which the reader should refer if contemplating work in the area (AFRO).

PETER ROCK MINING COMPANY LIMITED

In 1958, the Peter Rock Mining Company Limited had control of the property (Hesse 1958, p.2). The main showing was covered by 8 claims under a 99-year lease from the Algoma Central Railroad.

Hesse (1958) sampled the old trenches and recommended additional work. Halstead (1959b) also visited the property and recommended additional work, including drilling. Halstead (1959b, p.3) found 34 trenches dug into a shear zone 1,000 feet in length. Tailings at the old mill site assayed 0.46 ounces Au per ton indicating the presence of unrecovered gold values (Halstead 1959b, p.4).

HOLLINGER CONSOLIDATED GOLD MINES LIMITED

In 1964, Hollinger Consolidated Gold Mines Limited examined the property presumably under an option arrangement with Peter Rock Mining Company Limited. A property examination by the company reported that the shear zone hosting the gold contained pyrite, pyrrhotite, galena, sphalerite and arsenopyrite (MacDonald 1964a, p.7). The company completed a magnetometer survey and an electromagnetic survey over the property (MacDonald 1964b, 1964c). The electromagnetic survey outlined a number of conductors some of which were attributed to iron formation. In 1965 the company completed 20 diamond drill holes totalling 4534.6 feet (AFRO). This work is illustrated on Figure 46 along with the geology of the showing modified from plan maps of the Hollinger Consolidated Gold Mines Limited. The interesting gold values resulting from this drilling are given in Table 26. The drilling was discouraging and work discontinued.

CANAMAX RESOURCES LIMITED

In 1982, the Edwards gold occurrence was held under option from the Algoma Central Railway by Amax Minerals Exploration forerunner to Canamax Resources Limited (Yule 1982). This option was granted in 1978 (Yule 1983b, p.5). The Edwards Gold Occurrence gave interesting values upon surface sampling (Yule 1983a). In 1983, the company completed an Aerodat magnetic and electromagnetic survey over the southern part of Corbiere Township and identified a conductive horizon close to or on strike with the Edwards Gold Occurrence (AFRO, Toronto).

In 1983 the company completed a total of four drill holes totalling 273 m beneath the more promising area of the showing. The location of these holes is given on Figure 46. Only two intersections had gold values in excess of 1.0 ppm (McKay 1984, p.4). These intersections are: hole two from 26.0 to 27.05 m, 1.24 ppm Au; and hole 3 from 28.0 to 29.0 m, 8.24 ppm Au (McKay 1984, p.4). The results were discouraging and the property dropped.

GETTY MINES LIMITED

Getty Mines Limited completed a major base metal program in the Wawa area in 1972. This program centered on Abotossaway, Corbiere and Aguonie townships with most of the work being concentrated in Corbiere Township. The company completed 3 diamond drill holes in Abotossaway Township and 4 in Corbiere Township. The reader should refer to Abotossaway Township for the drilling in that township and to the Big Lake and Cline Lake Iron Ranges for a discussion of the diamond drilling in Corbiere Township. The company donated records for this program to the Ontario Geological Survey and the results of their program will be discussed for each showing for which records of work are present. The reader should refer to Bryant et al. (1972), Reilly (1973) and Anonymous (1974). A large and voluminous report was prepared for the company by Bryant and White (1973). On the basis of the limited drilling by the company which resulted in very low base metal and gold values, work in the area by the company was terminated (Anonymous 1974).

HOLDSWORTH IRON RANGE (19)

The Holdsworth Iron Formation is known as the Holdsworth pyrite deposit but its stratigraphy suggests it is an iron formation perhaps correlative to the Kathleen Iron Range (Sage 1987a). The Holdsworth Iron Range occurs in the southern part of Corbiere Township north of the Algoma Central and Hudson Bay Railroad spur line tracks to Wawa. The property was staked in 1918 by Mr. John Holdsworth (Collins and Quirke 1926, p.123, Collins 1918, p.24E). Prospecting in this area was stimulated by the presence of a large mass of pure massive pyrite on the shore of a small lake on claim SSM1054 (Collins and Quirke 1926, p.123; Collins 1918, p.24E). The discovery of this float occurred prior to 1914; however, the Holdsworth pyrite occurrence was not found until 1918 (Collins and Quirke 1926, p.123; Collins 1918, p.24E). Collins and Quirke (1926, p.123) Collins (1918, p.24E) reported that the original Holdsworth discovery consisted of a 2 foot wide band of dull black powdery material referred to by prospectors as "black sand" and it is doubtful that the block of pyrite float actual came from the Holdsworth Iron Range. The Holdsworth Iron

Range is not exposed in outcrop. Numerous iron ranges to the northeast contain massive pyrite and the specimen could have been transported by glacial ice from any one of them.

The Holdsworth Iron Formation has intermediate to felsic sericite schists along its south side and intermediate to mafic massive and pillowed metavolcanic rocks to the north. On the basis of volcanic stratigraphy, the stratigraphic section faces north. Some feldspar crystal tuff is also present within the intermediate to felsic metavolcanic rocks exposed along the south side of the iron formation.

The author has tentatively correlated the Holdsworth Iron Range with the Katheleen Iron Range located to the southwest (Sage 1987a). Electromagnetic conductors on airborne electromagnetic surveys completed by Canamex Resources Limited indicate the Katheleen and Holdsworth iron ranges are not on strike (AFRO). If they are the same iron formation unit the Holdsworth Iron Range has been thrust above the Katheleen Iron Range in a manner similar to that proposed by the author for the Rand No.2 Iron Range.

The Katheleen and Holdsworth iron ranges cap subcycle one volcanism and mark the beginning of cycle one volcanism. The Judith Iron Range in McMurray Township (1987a) is the southwest extension of the Katheleen Iron Range and one should compare the thick section of mafic and felsic metavolcanic rocks separating the iron formation capping subcycle one from the Michipicoten-type iron formation capping cycle one with the same section separating these two iron formations in southern Corbiere Township. The section representing cycle one volcanism thins considerably from west to east. This thinning may be in part real but tectonism may be a more dominant influence. The rocks in this area are very schistose and moderately to highly carbonated.

ALGOMA STEEL CORPORATION LIMITED

In 1918 or early 1919, the Algoma Steel Corporation obtained an option on the property from Mr. John Holdsworth (Collins and Quirke 1926, p.123). The company may have conducted surface work but there is no record of it. The company completed 22 diamond drill holes totalling 11,498.5 feet in 1919 (AFRO, Figure 47). The drilling identified two pyrite lenses separated by 200 feet which dip 65 to 70| north (Collins and Quirke 1926, p.124). The most eastern lens was identified for 1000 feet to a depth of 525 feet with a width of 18 to 25 feet at the 125 to 240 foot level (Collins and Quirke 1926, p.124). The western lens is 600 feet in length and was drilled to a depth of 490 feet where it had a width of 31 feet (Collins and Quirke 1926, p.124). The Algoma Steel Corporation estimated that 900,000 tons of pyrite grading 46.31% sulphur was present (Collins and Quirke 1926, p.124). The pyrite horizon has sharp contacts with the metavolcanic rocks and thin bands of metavolcanic rocks occur within the pyrite (Collins and

Quirke 1926, p.124).

GRASSELLI CHEMICAL COMPANY LIMITED

Presumably the property was purchased by the Grosselli Chemical Company Limited from Mr. John Holdsworth sometime around 1926 and between August and September 1926 the company completed 8 diamond drill holes (AFRO, Figure 47) totalling 3,762.5 feet (AFRO). Revised tonnage estimates were 592,332 tons grading 46.05% sulphur in the west lens and 426,941 tons grading 46.30% sulphur in the east lens (AFRO). Total tonnage was estimated as 1,019,273 tons grading 46.14% sulphur (AFRO). The tonnage figure was reduced 20% in the calculation process to allow for dilution (AFRO).

CANADIAN PYRITES LIMITED

The Grasseli Chemical Company was purchased by E.I. DuPont de Nemours and Company probably in 1929 (McAuslan 1974). The property became part of the holdings of the Canadian Pyrites Limited a subsidiary of E.I. DuPont de Nemours and Company. The Canadian Pyrites Limited conducted an electrical survey over the property in 1930 identifying a number of conductors including the pyrite horizons (AFRO). No follow up work was reported.

DUPONT OF CANADA EXPLORATION LIMITED

Dupont of Canada Exploration Limited obtained the Holdsworth property when they purchased Canadian pyrites Limited from E.I. DuPont de Nemours and Company in 1959 (McAuslan 1974). The company briefly examined the property in 1974 and determined that low base and precious metal contents precluded any interest in the property by the company (Harron 1974). It was recommended the company dispose of the property (Harron 1974).

O'REILLY, DENNIS

The property was purchased from Dupont of Canada Exploration Limited in 1974. O'Reilly completed surface prospecting of his property and found the O'Reilly quartz scheelite vein. This discovery is discussed under the heading "O'Reilly quartz scheelite vein (23)".

FALCONBRIDGE LIMITED

The O'Reilly property was optioned by Falconbridge Nickel Mines Limited in 1982 or 1983. The main purpose of this option was to check out the nearby Soocana-Holdsworth gold occurrence and not the Holdsworth Iron Formation. The work completed by Falconbridge Nickel Mines Limited on the gold showing will be discussed under

"Soocana-Holdsworth Gold Occurrence (26)". The company completed two diamond drill holes on the Holdsworth Iron Range as part of its exploration effort (AFRO).

These drill holes are numbers OR-4 and OR-5 and total 967.9 feet (Figure 47). Nearly all analysis in hole OR-4 were nil gold with a rare assay of 0.02 ounces per ton (AFRO, Toronto). Between 104.4 and 106.0 m a value of 4,000 ppb Au and 0.35% zinc was obtained (AFRO). This interval is described as felsic tuff containing 0.8 m of quartz carbonate stringers with 5% pyrite and 2% ZnS (AFRO).

Hole OR-5 was assayed for gold. The values generally varied from less than two to 34 ppb (AFRO). Between 99.5 and 104.8 m the Au varied from 34 to 130 ppb and the rock was described as massive pyrite with quartz veins (AFRO).

The gold values were too low to stimulate additional work. With the conclusion of the Falconbridge Nickel Mines Limited drilling a total of 16,228.9 feet of drilling have been completed on the Holdsworth Iron Range.

INTERNATIONAL CORONA RESOURCES LIMITED (44)

As a follow up to an airborne magnetic and electromagnetic survey completed in 1983, Manwa Exploration Services briefly examined a number of conductors in Corbiere Township (Neelands et al. 1984a). These conductors are tabulated in Table 27.

All checked conductors were previously known iron formation with the exception of anomaly 6140 m - 6180 m in northeastern Corbiere Township (Neelands et al. 1984a). The cause of this anomaly is unexplained.

JALORE MINING COMPANY LIMITED

The Jalore Mining Company Limited completed a large volume of work in Corbiere Township on the various iron ranges. This work consisted of sampling, geologic mapping and diamond drilling. This work took place on the Big Lake, Central Brooks, Cline Lake, East Brooks, Reau-Mary Lakes, Sheldon Lake and West Brooks Iron Ranges. The reader should refer to the respective iron range for a discussion of the work completed by this company.

JOSEPHINE IRON RANGE (20)

The Josephine Iron Range is that portion of the Michipicoten Iron formation extending from the east boundary of claim A.C. 289 to the southwest corner of Parks Lake. The Iron Range merges with the Bartlett Iron Range to the east and the Josephine West Extension Iron Range to the west.

The original discovery was by Alois Goetz in 1899; however, staking by Goetz and representatives of E.V. Clergue occurred contemporaneously leading to legal disputes (Collins and Quirke 1926, p.121). Collins (1918, p.25E) and Collins and Quirke (1926, p.121) summarized this dispute and its outcome as follows:

> "The iron range adjacent to Parks Lake, in township 28, range 25 (mining claims Y 451-2-3), is known as the Josephine property. This part of the range was staked at about the same time in 1899 by rival representatives of E.V. Clergue and Alois Goetz, following which the ownership remained in dispute until August 25, 1906, when a settlement was arbitrated by Honourable Frank Cochrane, who ruled:

"The above mining claims (Nos. 738-747 inclusive, in Michipicoten Mining Division), otherwise known as the Josephine iron mine, have for a long time been in controversy between Alois Goetz et al. and the Algoma Central and Hudson Bay Railway Company, the former claiming them by virtue of original discovery and the latter under the land grant made by the Legislative Assembly of Ontario.

"Having gone thoroughly into the case ... I am bound in equity to recognize Goetz's claim, but in view of the large amount of work done and money expended on the lands by the company, I think they should have the opportunity of acquiring the same at a reasonable figure.

"I, therefore, rule that, on the company paying to Goetz the sum of $50,000 the ten claims in question ... be allowed to the company. In default of the company paying over, or securing, to Goetz the said sum of money within thirty days from this date, Goetz to have the liberty of choosing five of the claims, the remaining five to be given to the company."

Following this decision Goetz selected claims 738, 739, 744, 745 and 746 and in October, 1906, had them surveyed as Y 455, 454, 451, 452 and 453, respectively."

The Josephine iron range caps north-facing intermediate to felsic metavolcanic rocks of cycle one volcanism. The range is overlain by intermediate to mafic massive and pillowed metavolcanic rocks and metasedimentary rocks. The upper contact of the iron formation is likely a zone of strike slip faulting associated with the Magpie River Fault which has locally cut out the intermediate to mafic metavolcanic rocks placing metasedimentary rocks in fault contact with the iron formation. At the Lucy Iron Range approximately 1000 m of intermediate to mafic volcanic rocks separate the metasedimentary rocks from the iron formation (Sage 1987a). Locally this thick section of metavolcanic rocks is absent due to low angle faulting cutting out portions of the stratigraphic section.

North of the iron range the stratigraphy faces south opposite to that south of the iron range. Richter (1952, p.41) places a synclinal fold axis along the trend of facing reversals; however, the author would interpret this zone of facing reversals as a zone of faulting related to the extension of the Magpie River Fault.

The underlying intermediate to felsic metavolcanic rocks consist of lapilli tuff, breccia, feldspar crystal tuff, sericite schist, polymictic tuff, laminated tuff and quartz-feldspar crystal tuff. The rocks are very schistose and pervasively soaked with carbonate. The sequence contains finer tuffs and smaller clasts than the section below the Helen Iron Range (Sage 1987a). Fiamme-bearing outcrops were observed northeast of the No.1 shaft suggesting the presence of ash flows. Crosscutting phreatic explosion breccias were observed northeast of the No.1 shaft below the iron formation. These breccias are cemented with dark chocolate brown weathering siderite and quartz (Plate 16). The phreatic breccias, however, are better exposed in the Ruth, Lucy and Helen Iron Range (Sage 1987a).

Moore and Armstrong (1946, p.41, 42) described the intermediate to felsic metavolcanic rocks as carbonated agglomerates and tuff similar to the Wawa tuffs near the Helen Iron Range. Moore and Armstrong (1946, p.42, 43) mapped the metasedimentary rocks west of Parks Lake and above the Josephine-Bartlett Iron Ranges as felsic metavolcanic rocks. These metasedimentary rocks display good bedding, crossbedding and rare ripple marks.

Calvert (1983, p.20) reported that the fragmentals in the intermediate to felsic section are dominantly oligomictic. Calvert (1983, p.26) reported the presence of small grains of chloritoid in the felsic metavolcanic rocks and one sample contained fracture-controlled cordierite. The presence of chloritoid within the felsic metavolcanic rocks is not visually evident in hand specimen (Calvert 1983, p.26).

Using chemical data supplied by the Ontario Geological Survey Calvert (1983, p.44) recognized a strongly bimodal sequence of metavolcanic rocks. This consists of a lower tholeiitic intermediate to mafic section and a overlying calc-alkaline intermediate to felsic metavolcanic section (Calvert 1983, p.44).

A brief study of the minor elements by Calvert (1983, p.38-43) suggested to him that K, Na, Ba and Sr were mobilized and that the felsic rocks were enriched in incompatible elements.

The supracrustal rocks were interpreted by Calvert (1983, p.44) to be deposited in a shallow subaqueous environment. The rock chemistry used by Calvert (1983) is presented in the appendix of this report along with all the chemistry completed in the four townships covered by this report.

Below the intermediate to felsic metavolcanic rocks lies a ferruginous carbonate unit with a crisscrossing pattern of milky quartz stringers. The underlying mafic breccia and carbonate units can be traced eastward to Siderite Lake below the Bartlett Iron Range. The abundance of milky quartz stringers in the carbonate unit appears restricted to the Parks Lake area since outcrops of this unit at Siderite Lake and below the Ruth Iron Range do not contain an abundance of these quartz stringers.

The positioning of this ferruginous carbonate unit is illustrated on Figure 33.

Below the ferruginous carbonate unit and capping the intermediate to mafic metavolcanic rocks lies a thick, continuous, polymictic, highly carbonated mafic breccia. Reaction rims are common on the clasts and rare isolated iron formation clasts were found.

Calvert (1983, p.18) reported the presence of chloritoid in this unit east of Parks Lake. The mafic breccia at this location is heavily carbonated and also displays reaction rims on some of the clasts.

In thin section, Calvert (1983, p.26) reported the presence of randomly oriented stilpnomelane which may comprise up to 15% of the rock. Fragments display a preference to stilpnomelane replacement over that of the matrix and some fragments may contain 90% stilpnomelane (Calvert 1983, p.26). Since the fragments contain more stilpnomelane than matrix the fragments may have been altered prior to encorporation into the tuffs.

Iron formation fragments in the mafic breccia appear to be restricted to outcrops south of Parks Lake for they were not noted in the type section below the Lucy Iron Range (Sage 1987a) or in outcrops east of Parks Lake.

Below the mafic breccia unit thin discontinuous lenses of cherty, graphitic and pyritic iron formation are present. The pyrite is commonly concretionary and thin beds of wacke or siltstone may be present. The reader should refer to figure 33 for the positioning of these very thin iron formation units.

The underlying amygdaloidal intermediate to mafic massive to pillowed metavolcanic rocks are pervasively soaked with carbonate and randomly oriented chloritoid porphyroblasts are common at the top of the mafic section. The porphyroblasts display a preference to pillow selvages, however, they may occur throughout the pillow structures. Detailed studies of the chloritoid alteration have been completed by Worona (1982) and Lockwood (1983). The results of these studies have been previously summarized (Sage 1987a).

The chloritoid-bearing rocks define a conformable strata-bound zone approximately 100 m thick from Parks Lake to Siderite Lake.

Moore and Armstrong (1946, p.44) also reported the presence of chloritoid in a band of felsic metavolcanic rocks extending across the south part of their map area which could not be located by this field party. Visual identification of chloritoid was restricted to rocks of intermediate to mafic composition even though its presence in more felsic compositions has been observed in thin section (Calvert 1983, p.26). Chloritoid was reported in dikes of unspecified composition from the bed of Parks Lake (Moore and Armstrong 1946, p.44).

The pillow structures commonly display almond-shaped amygdules filled with white quartz or ankeritic carbonate. The amygdules are concentrated in the pillow rims and not uncommonly exceed 1 cm in long dimension. The large amygdule size could infer low pressure and thus shallow water (Moore 1965).

Calvert (1983, p.25) reported the presence of tourmaline in one of his samples.

At the east end of Endless Lake, a small mafic to ultramafic intrusion is present which appears similar to those found at Lena, Mildred and Bauldry Lakes (Sage 1987a). The author interprets these mafic bodies as being emplaced into the Magpie River Fault, particularly where this fault is cut by northwest-striking transverse faults (Sage 1987a). Moore and Armstrong (1946, p.71) described an old diabase intrusion with ophitic texture in the bottom of Parks Lake consisting of saussuritized feldspar, epidote, chlorite and serpentine which may be a similar to the small mafic intrusion at the east end of Endless Lake. Other previously described "old diabase" in the map area have been interpreted by the author as Archean mafic intrusions of gabbro to diorite composition (Sage 1987a) however the report of the presence of serpentine in the "old diabase" at the bottom of Parks Lake suggests the possibility that it may correlate with some of the metaperidotite intrusions associated with the Magpie River Fault that passes through the lake bottom. The intermediate to mafic metavolcanic rocks at Endless Lake and west and north of Endless Lake are schistose and soaked with carbonate.

The metasedimentary rocks on the west side of Parks Lake consist of thin bedded siltstones and wacke with wacke increasing towards the west and away from Parks Lake. In the vicinity of Parks Lake the metasedimentary rocks are locally folded and a pronounced fracture cleavage cuts the bedding. Westward away from the lake the wackes locally display good cross bedding and rare ripple marks have been observed.

Moore and Armstrong (1976, p.45) mapped the thin bedded siltstones and wackes along the northwest shore of Parks Lake and at the north end of Parks Lake and mentioned the presence of metasedimentary rocks at Kimbell Lake. They classified the metasedimentary rocks on the northwest side of Parks Lake as arkose with some impure quartzite and little wacke (Moore and Armstrong 1946, p.45). A band of conglomerate is reported by them to occur in the bottom of Parks Lake which contained quartz pebbles up to 2 inches in diameter (Moore and Armstrong 1946, p.45). As mentioned previously by the author, Moore and Armstrong (1946, p.45) reported that the metasedimentary rocks and felsic metavolcanic rocks are gradational and are difficult to subdivide. The pebble variety reported by them consists of banded chert from iron formation, rhyolite, greenstone and unspecified local rocks.

The metasedimentary rocks at the north end of Parks Lake were classified by them as fine-grained, almost slatey, to somewhat laminated wacke (Moore and Armstrong 1946, p.45).

The Josephine Iron Range caps the intermediate to felsic metavolcanic rocks of cycle one and it in turn is overlain by intermediate to mafic metavolcanic rocks of cycle two and clastic metasedimentary rocks derived from cycle two metavolcanism.

The iron formation in outcrop consists of massive and thin bedded chert cemented with iron oxides. The Josephine mine produced hematite from the stratigraphic position in the iron formation in which siderite is present east and west of the mine. Ore grade hematite does not occur in surface exposure (Brown and Morrison 1942, p.15). The hematite ore zone occurs in the footwall of the iron formation and consists of a hematite cemented breccia (Brown and Morrison 1942, p.7). The greater the brecciation the greater the quantity of hematite (Brown and Morrison 1942, p.7). Brown and Morrison (1942, p.7) described the presence of high grade hematite lenses which they described as sub-conchoidal, hard, dense, red in colour which may on occasion show drusy cavities lined with specularite and quartz crystals. Lenses of massive hematite are reported to be present at depth in the mine and the silica content in the ore is reported to decrease with depth (Brown and Morrison 1942, p.7). The Josephine hematite is low in phosphorous but may be high in sulphur due to the presence of pyrite (Brown and Morrison 1942, p.8). Brown and Morrison (1942, p.8) described some ore specimens as siderite filled fractures in quartz cut by hematite-filled fractures, which in turn are cut by pyrite-filled fractures. To a depth of 1,000 feet over a length of 1200 feet Brown and Morrison (1942, p.8) indicate a quartz-hematite breccia zone with an average width of 30 feet averaging approximately 40% iron.

On the basis of cross-cutting relations of siderite- and hematite-filled fractures, lack of siderite in the ore zone to depths of 1500 feet and textures suggesting hematite replaced quartz, Brown and Morrison (1942, p.9) proposed an hydrothermal origin for the Josephine hematite. A similar theory was expressed by Moore and Armstrong (1946, p.52), Gallie (1947a, p.598) and Morrison (1948, p.430).

Gallie (1947a, p.598) described the Josephine ore body as a tabular mass of siliceous hematite with a vertical dip. The quartz mass of the iron formation has been brecciated and the fractures and interstices filled with hematite (Gallie 1947a, p.598). Both hard and soft hematite is reported to be in the ore zone with the soft hematite being interpreted by Gallie (1947a, p.600) as having resulted from crushing of the hard hematite. The cavities in the hard hematite may be as large as 1 foot across and one cavity 10 feet by 12 feet by 12 feet was encountered (Gallie 1947a, p.600).

Morrison (1948, p.48) reported the presence of locally occurring manganite and pyrolusite in the hematite ore.

The iron formation is described by Moore and Armstrong (1946, p.44) as a vertically dipping banded silica member varying from 80 feet to 700 feet in width. In the bottom of Parks Lake the iron formation pinches out in two places due to faulting and reaches a maximum width of 300 feet at Jasper Island (Moore and Armstrong

1946, p.44). The iron formation forms a high ridge on the east shore of Parks Lake which decreases in elevation eastward.

The iron formation exposed in the bottom of Parks Lake when Parks Lake was drained is described by Moore and Armstrong (1946, p.44) as white, brown and yellow, finely to coarsely banded, fine- to coarse-grained silica which is extensively brecciated and injected with later quartz.

Moore and Armstrong (1946, p.45) mentioned the presence of a band of iron formation 1,600 feet south of Kimball Lake that is 1800 feet long and 60 feet wide and a second band of silica 200 feet farther south that is 600 feet long and 160 feet wide. These iron formations do not appear to be of economic importance (Moore and Armstrong 1946, p.45).

The discovery and mining of hematite and goethite ores at the Helen Iron Range resulted in Coleman and Willmott (1902, p.171-173) proposing that these ores resulted from the weathering of primary siderite. AT the Helen Iron Range these oxidized ores reach a depth of 700 feet (Moore and Armstrong 1946, p.107; Canadian Mining Journal 1956, p.83) before encountering fresh siderite and were the focus of mining operations on this range from 1900 to 1918 (Sage 1987a). At the Josephine Mine hematite ores were encountered to the limits of the present workings at 1,000 feet and have been encountered in drilling to depths of 1500 feet (Brown and Morrison 1942, p.9). The oxide ores at the Josephine mine extend to much greater depths than those found at the Helen Iron Range.

At the Josephine mine the iron formation has been extensively brecciated in contrast to being dominantly deformed by folding at the Helen Iron Range. The faults at Parks Lake are part of the regionally extensive Magpie River Fault system which cut across the stratigraphy and locally the iron formation at relatively low angles. Minor examples of this style of faulting can be observed in the Josephine West Extension Iron Range (see Property 21, Corbiere Township).

In addition to the Mapgie River Fault the Josephine (Morrison) north-striking transverse fault cuts the iron formation on the east side of Parks Lake. The intersection of these two faults would create an ideal situation to permit access of surface waters to the iron formation. The collapse of the Josephine Mine in 1946 occurred at the intersection of these two fault trends. The Josephine hematite ore bodies occur at the fault intersection and east and west from this intersection point at the same stratigraphic position siderite occupies the identical stratigraphic position.

In addition to the positioning of the hematite ore bodies evidence of significant hematization and deposition of hematite in cross faults and fractures, which would be expected if hydrothermal fluids played a role in hematite deposition, is not present. The author is of the opinion that the Josephine hematite ore bodies are the result of brecciation and oxidation of primary siderite due to deep circulating groundwaters along fault zones at some unknown time in the geologic past.

Young (1953, p.117-121) called into question the hydrothermal origin of the Josephine hematite presented an alternative interpretation of the observations of Brown and Morrison (1942) which supported an oxidation of primary siderite. Young (1953, p.118) interprets the banded hematite-silica to result from hematite replacement of siderite bands and not of silica. Young (1953, p.118) interpreted hematite cross-cutting other rock types to be the result of percolating fluids and that it is not necessary to make hydrothermal fluids to obtain the observed cross-cutting relations. Young (1953, p.119) was the first to recognize that faulting controlled the location of ore bodies and to recognize that if hydrothermal fluids entered these faults the hematite ore bodies should extend beyond the iron formation and not just occupy the stratigraphic position of siderite in the iron formation.

The extension of the hematite deposits to depth as an argument in favor of hydrothermal origin is also questioned by Young (1953, p.119). He pointed out (Young 1953, p.119) that the water table is perched, a lake exists above the hematite ore body and a fault, which would permit deep circulation, is present; all of which could contribute to the development of the hematite ore without recourse to hydrothermal fluids. The author concurs with Young (1953, p.119) on the observation concerning the present position of the lake, faulting and ore, but can find no evidence supporting the interpretation that the hematite is the result of a recent geological event related to the present lake system or water table. The circulatory system forming the Josephine ore bodies could have been operative long ago in geologic time and have nothing to do with present circulatory systems and topography.

Young (1953, p.120) felt that strike faulting was particularly important in preparing the ground for deep circulating groundwaters. The author concurs with Young (1953) and has interpreted the dominantly strike-slip Magpie River Fault as a major influence in forming the Josephine ore bodies.

Young (1953, p.121) proposed that to generate a hematite ore body such as found at the Josephine iron mine one needs three things: 1) the presence of iron formation rich in iron 2) faulting, particularly strike-slip faults and 3) an overlying lake.

The author would restrict the first requirement to include iron formation containing siderite, considers the second as acceptable and rejects the third. To accept the third item one would have to establish the fact that the Josephine hematite ore bodies are a recent event due to the presence of Parks Lake. There is no evidence establishing this relationship and there is no evidence that Parks Lake was present before the last ice age. To generate these deep hematite ore zones below Parks Lake since the last ice age would require their formation within just a few thousand years, perhaps an unreasonably short period of time considering the length, width and depth of the hematite horizon.

Moore and Armstrong (1946, p.47, 48) described many dike rocks from the bed of Parks Lake and workings of the Josephine iron mine. These sites could not be visited by the field party and the reader should refer to Moore and Armstrong (1946) for data concerning these dikes.

Calvert (1983) completed a stratigraphic study of the Josephine Mine area concentrating on the area below the iron formation. The stratigraphy mapped by Calvert (1983) is presented in Figure 33 and represents a north-south traverse north of Bog Lake.

The structural geology of the Josephine mine area is complex and difficult to unravel at the present scale of mapping.

Near the mine site at the south shore of Parks Lake, a splay off the Magpie River Fault strikes east and is expressed by a pronounced topographic linear extending east from the south end of Parks Lake. This fault is an extension of the Brown Fault of Gallie (1947a, p.597) (Figure 48). Moore and Armstrong (1946, p.50) described this faulting as vertical and curving. Another splay off the Magpie River Fault is along the axis of Endless Lake. This fault is reflected in a prominent topographic linear and a well-developed schistosity. Moore and Armstrong (1946, p.50) reported diabase dike offset across the fault. This fault has not been named and as with the fault at the south end of Parks Lake neither fault can be traced for great distance because they parallel stratigraphy.

The easiest fault to recognize is the Josephine (Morrison) fault that strikes north along the east side of Parks Lake. This fault shows a fault scarp at the south end of Parks Lake and can be recognized by a left lateral jog in the stratigraphy across the fault.

Moore and Armstrong (1946, p.51) described this fault as dipping vertical to 85| west and striking 355|.

This fault cuts off the hematite ore bodies to the east and the eastern extension was not found (Moore and Armstrong (1946, p.51). Morrison (1948, p.431) considered the east side to be in excess of 1500 feet higher than the west side due to the absence of hematite ore bodies east of the fault. The author estimates a 25 m left lateral offset on this fault at the south end of Parks Lake.

A second fault parallel to the Josephine (Morrison) Fault has been identified by W.F. Morrison, for Michipicoten Iron Mines. This fault is known as the Endless Lake Fault and it joins with the Josephine (Morrison) Fault just north of the Josephine Mine shaft. The position of this fault is taken from unpublished maps prepared by W.F. Morrison, Michipicoten Iron Mines (see Figure 48).

HISTORICAL RESUME

For more details on the development of the Josephine iron mine the reader may wish to refer to Anonymous ? 1909, 1929, 1937a, 1937b); Bolton (1914); Brown (1943a, 1943b, 1943c, 1946); Goetz (1912, 1921, 1922, 1931); Hasselbring (1914); MacLeod (1931, 1943, 1946); Parsons (1915, p.205), Seelye (1909) and Willmott (1904).

Moore and Armstrong (1946) prepared a simplified historical background to the Josephine Iron Mine within the Josephine Iron Range. They prepared a lengthy description of the geology and published the first geological map of the property.

Gallie (1947a, 1947b) prepared a detailed report on the mining methods and ore beneficiation techniques used at the mine.

WILEY, H.A.

After discovery of the Josephine Iron Range Mr. H.A. Wiley of Port Arthur (Thunder Bay) optioned the discovery from Mr. Alois Goetz the discover. In approximately 1900, Mr. Wiley completed three diamond drill holes from Jasper Island totalling 618 feet (Anonymous 1909, p.8). As a consequence of the dispute over ownership between Alois Goetz and E.V. Clergue Interests work was discontinued. Figure 47 indicates the location of the Wiley drill holes. Lindeman and Bolton (1917, p.80) and Goetz (1922, p.1) indicated that the original drilling elow Parks Lake for hematite was based on the discovery of boulders of hematite along the shore of the lake.

LAKE SUPERIOR CORPORATION (ALGOMA STEEL CORPORATION LIMITED)

Between 1901 and 1903 the E.V. Clergue Interests drilled 21 diamond drill holes totalling 11,788 feet the locations of which are displayed on figure 48 (Anonymous 1909, p.8; Collins and Quirke 1926, p.121; Moore and Armstrong 1946, p.37, 38; Gallie 1947, p.591). The company completed one shaft 150 feet deep on the south shore of Parks Lake and a second shaft of 50 feet on the east shore of Parks Lake (Boyd 1903, p.62, 63, 1904, p.47; Collins and Quirke 1926, p.121; Moore and Armstrong 1946, p.37; Gallie 1947a, p.591). A grade for a spur line to the Algoma Central and Hudson Bay Railroad was prepared to the first shaft site. Due to the question of title to the property, work was discontinued.

ALGOMA STEEL CORPORATION LIMITED

In 1913 the Algoma Steel Corporation optioned the property from Alois Goetz and proceeded with a 5 hole diamond drill program (Collins and Quirke 1926, p.121; Moore and Armstrong 1946, p.37; Gallie 1947a, p.591; Sutherland 1915, p.106). These holes were numbered 50 to 54 and totalled approximately 4817 feet (AFRO, Toronto). No further work was done and the option was dropped.

MICHIPICOTEN IRON MINES LIMITED

In 1941, Frobisher Exploration Company Limited optioned the property from Mr. Alois Goetz in addition to the Ruth and Lucy properties (Moore and Armstrong 1946, p.38; Gallie 1947a, p.591, 592). In May of that year drilling from Greenstone Island in Parks Lake began and reached a total of 6,494.2 feet (Moore and Armstrong 1946, p.38; Gallie 1947a, p.591). This drilling is the S series of drill holes (Figure 48) (AFRO). On the basis of this drilling Michipicoten Iron Mines Limited was formed in the fall of 1941 and in February 1942 a 3-compartment shaft was started which reached a depth of 1,055 feet (Moore and Armstrong 1946, p.38; Gallie 1947a, p.592, see Plates 17a thru 17g). Stations were cut at 265, 415, 565, 715, 865 and 1055 feet and underground drilling was completed during sinking operations (Moore and Armstrong 1946, p.31).

In 1942, the Ontario Mining Court gave permission to drain Parks Lake and a creek draining into Parks Lake from Endless Lake was directed to Cliff Lake by tunneling through the outcrop separating the two lakes (Moore and Armstrong 1946, p.38; Gallie 1947a, p.592). Parks Lake was drained by October 1942 and underground development took place during 1943 and 1944 (Gallie 1947b, p.592). In 1944 the shaft was deepened, an underground crusher installed and surface facilities installed (Gallie 1947a, p.592).

In November 1945, production began and continued until October 1946 when a stope on the 600-foot level caved to surface permitting lake sediment and water to flood the mine workings (Callie 1947a, p.592). The flooding of the mine terminated operations at the mine.

The No.1 vertical shaft in the footwall of the Josephine Iron Range ultimately reached a depth of 1,225 feet and a sump was cut at the 7th level. Gallie (1947a, p.600, 601).

It was estimated that 80,000 cubic yards of material flowed into the Mine before the flow was stopped by some unknown plugging mechanism (Gallie 1947a, p.634-636). An abbreviated account of the collapse of stope 36 is given by Legget and Eden (1960, p.82).

In 1950-1951, Michipicoten Iron Mines completed a diamond drill program east of the Josephine (Morrison) Fault over to the west boundary of Claim AC 289. This drilling consisted of 18 holes referred to as the J series. Total footage is 8,822 feet (AFRO). Wendeborn (1951, p.4) indicated this drilling outlined 4,917,950 tons of siderite grading 35.90% iron, 11.84% silica and 12.33% sulphur. No further work by Michipicoten Iron Mines Limited has been reported.

Total production of the Josephine Iron Mine until cave-in was 191,712 tons and reserves of 3,965,000 tons grading 51.65% iron and 14.92% silica and 1.88% sulphur remain (Tower et al. 1949, p.95-

97, Tower et al. 1948, p.84-86).

ALGOMA STEEL CORPORATION LIMITED

On claim AL 289 adjoining the property of Michipicoten Iron Mines Limited, Algoma Steel Corporation completed four J-series holes, numbers 17 thru 20 in 1951 (AFRO). This drilling totalled 3,087 feet (AFRO). The approximate position of these holes is illustrated on Figure 41.

Barrett (1951, p.1) prepared a report on reopening the Josephine Mine in which hematite reserves were given as 2,445,550 tons grading 51.9% iron, 18.0% silica and 1.6% sulphur. Follow up work to the report on reopening the Josephine Mine was not reported.

There has been no significant exploration activity on the Josephine Iron Range since 1951. Table 28 presents a summary of surface diamond drilling completed to date on this iron range.

JOSEPHINE WEST EXTENSION IRON RANGE (21)

The Josephine West Extension Iron Range forms a prominent rusty weathering curvilinear ridge from Goetz Lake to the south shore of Parks Lake. The east end of the range merges with the Josephine Iron Range. At the west end the Goetz Lake Fault abruptly terminates the range. The Goetz Lake Fault is a left lateral transverse fault with an estimated 833 m horizontal offset. The west end of the Josephine West Extension Iron Range would correlate with the east end of the Ruth Iron Range with removal of the effect of faulting. The Goetz Lake Fault is referred to as the Josephine Fault by Moore and Armstrong (1946, p.51). The Josephine West Extension Iron Range has a strike length of approximately 488 m, a width of approximately 152 m and dips vertically.

On the north side of the iron range, a thin unit of intermediate to mafic metavolcanic rocks is present and above this wacke metasedimentary rocks. Locally the metasedimentary rocks display good crossbedding. The removal in this area of a large portion of cycle two intermediate to mafic metavolcanic rocks and placing of the metasedimentary rocks almost in direct contact with the iron formation is due to faulting along the Magpie River Fault.

The rocks are locally brecciated or fractured and carbonate alteration is common.

Below the iron formation an intermediate to felsic metavolcanic assemblage is present consisting of tuff, lapilli tuffs, sericite schist and quartz-feldspar crystal tuff. These rocks are very schistose and pervasively soaked with carbonate. On the basis of stratigraphy the iron range faces north.

The iron formation consists of massive to thinly laminated chert with heavy iron staining. In places the iron formation is brecciated and cemented with secondary iron oxides.

Diabase occurs in a number of spots and it is difficult to trace the dikes across some contacts and in some instances across the iron formation. There is likely a minimum of two dikes present which have been segmented by curvilinear faults splaying off from the main Magpie River Fault.

The fault pattern has been superimposed in Figure 48 on a geologic map prepared by Algoma Steel Corporation. The fault trends subparallel the fault trends of the Brown Fault of Gallie (1947a, p.597). The faulting and resulting lithologic variability in this area is far too complex to be illustrated at a map scale of 1 inch to 1/4 mile and additional work is warranted.

Offset on one diabase dike across a rock contact in one instance was estimated at 244 m.

Diamond drill logs by the Algoma Steel Corporation indicate that the siderite bordering the diabase dikes has been converted in part to magnetite as a result of contact thermal metamorphism. The presence of these aureoles of contact metamorphism would diminish the available mineable siderite. Goldsmith (1966) prepared a brief geologic report on this range but a summary report giving the results of the drilling could not be located.

ALGOMA STEEL CORPORATION LIMITED

In 1945, the Algoma Steel Corporation Limited completed 6 diamond drill holes on the Josephine West Extension Iron Range totalling 6,808 feet (AFRO). The company geologically mapped the iron range in 1966 and in 1968 and completed 10 short diamond drill holes totalling 1433.5 feet (AFRO). The position of the drill holes is given in Figure 49. No additional work has been completed. Total drilled footage is 8,241.5 feet.

NEWRIC IRON RANGE (22)

The Newric Iron Range occurs north of the Sheldon Lake Iron Range. The range averages 25 feet in width and is difficult to trace (Young 1951, p.4). Young (1951, p.4) interpreted the outcrop pattern to indicate it lensed out. Young (1951, p.4) described the iron formation as consisting of well banded silica and siliceous magnetite. Young (1951, p.4) reported the presence of siderite in the bands at the west end of the range and that it also is more brecciated towards the west.

With gaps, the Newric Iron Range may have a strike length of 1707 m.

The positioning of this band of iron formation in the stratigraphy is uncertain; it may be a thin relatively local iron formation. Their is no record of exploration activity on the range other than geological mapping by Jalore Mining Company Limited. This iron range was not visited during the present survey.

O'REILLY SCHEELITE VEIN (23)

After purchasing the former Soocana-Holdsworth gold occurrence and Holdsworth Iron Formation from Dupont Exploration Canada Limited in approximately 1974, Mr. Dennis G. O'Reilly prospected his holdings. Using an ultraviolet lamp Mr. O'Reilly uncovered a quartz vein containing scheelite in a railroad cut of the Algoma Central Railway.

The vein pinches and swells reaching a maximum width of 25 to 37 cm but is generally much thinner. The vein consists of milky quartz and rusty weathering ankeritic carbonate and minor scheelite. Parallel veins, generally thinner in width do not contain scheelite.

The vein cut carbonated intermediate to mafic tuff with rusty weathering ankerite. Scattered grains of disseminated pyrite are present.

Some bedding, locally graded, in the tuff indicate a strike of 70° and a dip of 51° N and grain gradation with tops to the south indicate local overturning. Schistosity strikes at approximately 60 dipping 51° N subparallel to bedding.

The vein has a strike of approximately 85° and dips north at approximately 45°. Approximately 3 m of vein were exposed south of the tracks before it became covered and approximately 1.5 m of vein was exposed north of the tracks before it pinched out. Grab samples were collected from the vein and the assay results are given in Table 29. Assays for gold returned nil values except for sample OR-2 which returned 0.01 ounces per ton. Tin values ranged from 9 to 26 ppm (Geoscience Laboratories).

While this scheelite vein is not likely to have any commercial importance, it does indicate the possibility that other scheelite-bearing veins may exist in the area. The very pale orange colour of the scheelite does not contrast with the iron stained quartz of the vein making initial recognition of the scheelite difficult. The vein is within easy walking distance of Hawk Junction in a well exposed outcrop. Undoubtedly this vein has been passed by many geologists and prospectors without the scheelite being noted.

REAU-MARY LAKES IRON RANGE (24)

The Reau-Mary Lakes Iron Range contrasts with most other iron ranges in the map area since it has no topographical expression and little outcrop. Geologic mapping and diamond drilling by exploration companies indicate a series of blocks or lenses of Michipicoten-type iron formation are present. Airborne electromagnetic maps produced for International Corona Resources Limited (AFRO) indicate a series of stacked short conductors. By overlying the geology and electromagnetic data the iron formation at Reau-Mary Lakes correlates with the Rand No.2 Iron Range to the east. The airborne electromagnetic maps indicate that numerous segments of iron formation likely lie between the two areas. On the basis of the position of the iron formation at the contact of intermediate to felsic metavolcanic rocks of cycle one with overlying intermediate to mafic metavolcanic rocks of cycle two, the southwest end of the Reau-Mary Lakes Iron Range likely correlates with the north end of the Cline Lake Iron Range.

The rocks north of the Reau-Mary Lakes Iron Range are highly carbonated, locally schistose, intermediate to mafic metavolcanic rocks. Shearing in places deforms the pillows into horseshoe shapes that renders them useless for the determination of facing directions. Limited facing data external to the Reau-Mary Lakes area suggest a north-facing stratigraphy even though some possible south-facing determinations have been made at random sites.

South of the iron range sheared massive intermediate to felsic metavolcanic rocks are present on Reau Lake. On Mary Lake, the intermediate to felsic metavolcanic rocks consist of schistose massive flows, lapilli tuff, feldspar crystal tuff and volcanic breccia. Some of the breccia has a matrix containing an abundance of dark chlorite. Sericite schists, in part possibly sheared tuff, are also present.

Chloritoid porphyroblasts occur in rocks of both felsic and mafic composition on the south side of Reau Lake. These chloritoid-bearing rocks appear to mark the northern limit of a broad zone of chloritoid porphyroblasts that occur in northeastern Corbiere Township.

The best outcrop or iron formation observed by the author is on a small low island in Reau Lake. This island consists of deeply weathered siderite with disseminated pyrite. Some of the pyrite was concretionary. Chloritoid porphyroblasts in chlorite schist were present. The chloritoid occurred in porphyroblasts up to 1 mm, were randomly oriented and locally comprise 30 to 40% of the rock.

At the east end of Reau Lake, a northeast-trending dike-like fine-grained felsic intrusion is present. This small intrusion is identical in appearance to the much larger hypabyssal intrusion at Big Lake. The intrusive nature of the small body at Reau Lake was recognized by Bruce (1940).

JALORE MINING COMPANY LIMITED

In 1953 Jalore Mining Company Limited prepared a geologic map of the Reau-Mary Lakes area and completed 7 short diamond drill holes in an attempt to outline the iron formation (Drury 1953; Sirola 1954c). This drilling totalled 456.4 feet (AFRO). The simplified geology with drill hole locations is shown on Figure 50. The discovery of the Reau-Mary Lakes siderite and pyrite is attributed to a Mr. Richards in 1953 while employed with the Jalore Mining Company Limited (Drury 1953).

CANDELA DEVELOPMENT COMPANY LIMITED

The Candela Development Company Limited continued the work of the Jalore Mining Company Limited in 1954. The company completed a self potential survey over the property and drilled 8 diamond drill holes totalling 2,092.1 feet (Sirola 1954a, 1954b; AFRO; see Figure 50). On the basis of this work no additional work was recommended and the property dropped. In Abotossaway Township to the north, Getty Mines Limited and Union Miniere Exploration and Mining Corporation Limited have completed diamond drill holes on airborne indicated electromagnetic conductors which are likely the extension of the iron formation found at the Reau-Mary Lake area.

SHELDON LAKE IRON RANGE (25)

The Sheldon Lake Iron Range extends from the north shore of Sheldon Lake in a curvilinear pattern until it merges with the Big Lake Iron Range near Twin Lake (local name). Richter (1952, p.44) indicated this iron range is 3,200 feet long and varies from 25 to 350 feet in width. Mapping by the field party in combination with airborne electromagnetic maps prepared for International Corona Resources Limited (AFRO, Toronto) suggest that with several possible gaps the Sheldon Lake Iron Range has a strike length exceeding 2440 m.

The Sheldon Lake Iron Range was discovered by prospectors for Jalore Mining Company Limited in 1950.

North of the Sheldon Lake Iron Range the rocks are dominantly intermediate to mafic metavolcanic rocks. Minor interbedded intermediate to felsic metavolcanic rocks consisting dominantly of schistose massive units and feldspar crystal tuff are present. The rocks are highly carbonated and some areas contain chloritoid porphyroblasts.

To the south a thin band of siltstone-wacke lies in contact with the iron formation at Sheldon Lake. This metasedimentary unit displays a prominent cross-cutting fracture cleavage.

Along the south shore of Sheldon Lake a thin unit of intermediate to mafic pillowed metavolcanic rocks is present. South of the mafic metavolcanic rocks lies an area of schistose intermediate to felsic metavolcanic rocks that is composed dominantly of feldspar crystal tuff. The rocks are generally very schistose and moderately to highly carbonated.

The stratigraphic relations of the Sheldon Lake Iron Range are thought to be modified due to strike-slip faulting prior to folding giving rise to the highly schistose series of rocks.

The Sheldon Lake Iron Range wraps partly around the nose of the Alden Lake Anticline and is separated from the East Brooks Iron Range to the south by a synclinal fold axis. The author would correlate the Sheldon Lake Iron Range with the east end of the East

Brooks Iron Range. Richter (1951, p.46) correlated the Sheldon Lake Iron Range with the Central Brooks Iron Range across the Marsden Fault and indicated the eastern extension was cut off by the McVeigh Creek Fault. The iron formation could not be traced east of Sheldon Lake so it never reaches the McVeigh Creek Fault. The strike at the west end of the range is to the northwest taking it away from the Marsden fault to the west.

The Sheldon Lake Iron Range was described by Young (1951, p.3, 4) as fine-grained breccia with granular silica. Siderite is reported to be mixed with the silica and locally the iron formation is well banded (Young 1951, p.4).

Richter (1952, p.45, 46) indicated that the Sheldon Lake Iron Range dips steeply south and that siderite occurs on its north side. If iron formation facies distribution can be used to determine facing direction, the siderite on the north side of the range indicated the iron formation faces south.

Where encountered in outcrop by this field party the iron formation consists dominantly of chert breccia cemented with iron oxide.

JALORE MINING COMPANY LIMITED

After discovery of the iron formation in 1950 by prospectors working for the Jalore Mining Company Limited the company completed geological mapping of the Sheldon Lake Iron Range.

CANDELA DEVELOPMENT COMPANY LIMITED

The Candela Development Company Limited a subsidiary of the Freeport Sulphur Company apparently optioned this iron range along with the Big Lake and Reau-Mary Lakes Iron Ranges in 1953 from the Jalore Mining Company Limited. The company completed self potential geophysical surveys over the property and drilled 6 diamond drill holes in 1954 (AFRO). This drilling totalled 1,756 feet (AFRO). This drilling along with a simplified geologic plan is given in Figure 51. The drill logs indicate an increase in pyrite and pyrrhotite content to the north and the presence of graphitic schist zones (AFRO). Siderite was not noted on the drill logs and the presence of sulphide facies iron formation on the north side of the iron range is consistent with the south-facing stratigraphy.

SOOCANA-HOLDSWORTH GOLD OCCURRENCE (26)

The Soocana-Holdsworth Gold Occurrence lies just north of Pokorney Lake (local name) and just north of the boundary between Corbiere and Esquega townships. The occurence is easily accessible by rail from Hawk Junction.

The occurence was presumably discovered by Mr. John Holdswoth before 1933 who prospected this area and discovered the Holdsworth Iron Range north of the gold occurrence.

The quartz vein comprising the Soocana-Holdsworth Gold Occurence strikes west to 285| and has a subvertical dip. The vein consists of milky quartz with minor carbonate and sulphide mineralization. Near the old mill site located where the vein rapidly expands and has been open cut, disseminated pyrite and chalcopyrite are present in the vein. At this position where the vein suddenly widens visible gold can be found. Burwash (1935, p.17) reported that pyrrhotite, tourmaline and galena also occur in the vein. Chalcopyrite, pyrrhotite and tourmaline were confirmed by the field party but galena could not be found.

The host rock for the vein is a mafic intrusion locally sheared to a chlorite schist. Chlorite clots up to 1.5 mm in some least sheared sections on the outcrop containing the wide vein section may be former mafic phenocrysts completely altered to chlorite. The contact of the vein with the host rock is marked by chlorite schist and locally some minor sericite schist. The vein width varies widely from location to location as does the amount of carbonate. What is thought to be the same vein was traced for 213 m in old trenches. The vein occupies a ductile shear zone which may display minor left lateral offset across a northwest-trending transverse fault. This fault zone is now occupied by a diabase dike exposed at the open cut and drag along this fault may perhaps account for the vein thickening since this thickening occurred at the east contact with the diabase dike. A parallel diabase dike is reported to be present east of the dike exposed in the open cut and this second dike also reportedly cuts the vein (Burwash 1936, p.17).

Gold values occur only where sulphide is present, generally chalcopyrite.

Burwash (1935, p.18) reported that 4 to 5 foot widths with alternating bands of quartz and carbonate were encountered in diamond drilling, however gold occurred only where chalcopyrite was observed. Pyrite mineralization was not an apparent indicator for gold (Burwash 1935, p.18).

Grab samples of the vein material were collected by members of the field party for assay. A sketch of the geology and sample locations is given in Figure 52. The assay values obtained are given in Table 30. The assay values show very erratic gold values with economically interesting values being restricted to the area of vein thickening at the old open cut.

Gledhill (1934, p.2) described the Soocana vein as 3 to 14 feet wide, 2,000 feet long and dipping steeply north. The widths and length appear optimistic and the dip could not be confirmed on the existing exposures. The property produced 10 ounces of Au and 5 ounces of Ag in 1933 (AFRO).

HOLDSWORTH GOLD MINING COMPANY

The property was originally under the control of the Holdsworth Gold Mining Company presumably formed by Mr. John Holdsworth, discoverer of the vein. This company was presumed defunct by 1938 (Canadian Mines Register of Dormant and Defunct Mines, p.183). There are no records of work by the company.

SOOCANA MINING COMPANY LIMITED

The Soocana Mining Company was incorporated in 1933 to take over several mining properties in the Hawk Junction area. It acquired the Soocana Holdsworth property and 6 diamond drill holes were drilled under the direction of B.C. Lamble to test the vein in 1933 (AFRO; Plate 18). The company set up a 5 ton test mill and made an open cut in the more promising part of the vein (Gledhill 1934, p.2). Gledhill (1934, p.2) states that a 60 ton sample recovered 8 dollars per ton in gold with $3.50 in gold left in the tails. These values are a $20.67 (U.S.) per ounce (Gledhill 1934, p.2).

The company claimed to have an ore section 100 feet long by 28 inches wide grading 0.46 ounces per ton (AFRO). The Soocana Mining Company Limited was reported to be out of business in 1946 (Canadian Mines Register of Dormant and Defunct Mines, p.362). A shaft indicated to be present on plan maps prepared by the company could not be located.

FALCONBRIDGE NICKEL MINES LIMITED

In 1935 Falconbridge Nickel Mines Limited sampled the vein and estimated an ore shoot 100 feet long by 37 inches wide containing 0.39 ounces Au per ton (AFRO). No further work was completed.

ERIE CANADIAN MINES LIMITED

Erie Canadian Mines sampled the property in 1938 and the assay plan on file in AFRO, Toronto indicates erratic but interesting gold values. The property at this time may have been held by the Holdsworth Mining Company a presumed successor to the Holdsworth Gold Mining Company. The charter for the Holdsworth Mining Company was cancelled in 1952 (Canadian Mines Register of Dormant and Defunct Mines, p.183).

COMPASS GOLD MINES LIMITED

Compass Gold Mines Limited was incorporated in 1937 and obtained control of the Soocana-Holdsworth Gold Occurrence sometime in late 1938 and before 1940 (Canadian Mines Register of Dormant and Defunct Mines, p.100). There is no record of work by the company.

SYLVANITE GOLD MINES LIMITED

In 1940, while under control of Compass Gold Mines Limited, the property was sampled by Sylvanite Gold Mines Limited. The sampling plan indicates erratic but interesting gold values (AFRO). No additional work was reported.

FALCONBRIDGE LIMITED

In 1982 the former gold showing of Soocana Mines Limited was optioned from Mr. Dennis G. O'Reilly by Falconbridge Limited. The company was interested in the gold showing based on sampling it had previously completed in 1935.

In early 1983, Falconbridge Limited completed a Dighem survey of the property and nearby area and outlined a number of conductive horizons warranting ground investigation. In the summer of 1983, the company completed a geologic map of the property including the Holdsworth Iron Range located northeast of the gold showing (AFRO). The company also completed humus and rock sampling looking for geochemical anomalies, principally of gold (AFRO). Magnetic and VLF-EM Surveys were completed over the property and several conductive horizons containing pyrite were delineated (Walker 1983). The company completed 5 diamond drill holes on the property 3 of which were on the gold showing and the remaining two were discussed previously under the heading of the Holdsworth Iron Range.

The 3 holes completed on the gold showing totalled 295 m (AFRO). Diamond drill holes 1 and 2 were on the No.1 vein of the Soocana-Holdsworth gold occurrence. The best value in hole OR-1 was 0.06 ounces Au per ton from 30.0 to 31.5 m in spotted chlorite schist with tourmaline and several quartz plus carbonate veins (AFRO). In hole OR-2 drilled to confirm results in Soocana hole S-6 the best values were 0.02 ounces Au per ton which occurred in several samples (AFRO). The location of the old holes and new holes is indicated on Figure 53. The new drilling could not confirm the old values.

Hole OR-3 was drilled south beneath Pokorney Lake and several values of 0.002 ounces Au per ton were obtained (AFRO). One value of 0.05 ounces per ton from 101.1 to 102.6 m was reassayed by the company and returned nil gold on the reassay (AFRO). This sample was a mixture of wall rock and a quartz tourmaline vein (AFRO).

The records for the work by Falconbridge Limited were donated to the Ontario Geological Survey by Mr. Dennis O'Reilly.

WEST BROOKS IRON RANGE (27)

The West Brooks Iron Range is located in west Central Corbiere Township. The discovery of the range has not been recorded but presumably it was found by prospectors working for the Lake Superior Corporation just before 1912. To the north of the iron range intermediate to felsic rocks are present consisting of breccia with chloritic matrix, sericite schist, lapilli tuff, tuff and quartz-feldspar crystal tuff. The intermediate to mafic rocks associated with the intermediate to felsic rocks are dominantly tuff.

To the south, the rocks are massive to pillowed intermediate to mafic metavolcanic rocks. Facing data based on pillow shape indicates a south-facing stratigraphy. Geologic maps prepared by Jalore Mining Company Limited indicate siderite and pyrite on the north side of the range which is consistent with south-facing stratigraphy assuming the carbonate facies iron formation is always at the bottom (Drury 1951, p.5).

The rocks in this area are pervasively soaked with carbonate and commonly very schistose. On several unnamed lakes just west of the iron range, chloritoid porphyroblasts are common in rocks of both mafic and felsic composition. The iron range is subvertically dipping, at least 3,000 feet long and less than 100 feet wide. Richter (1952, p.42) indicate the range as one mile in length and averaging 70 feet in width.

Facing determinations by Richter (1952, p.42) also indicated a south-facing stratigraphy.

Mapping by Jalore Mining Company Limited indicates a segmented iron formation (Figure 54). McKee (1950, p.6) and Drury (1951, p.6) indicate four segments over a length of 5300 feet. McKee (1950, p.6, 7) suggested that the iron formation may dip steeply north.

The iron formation is described by Drury (1951, p.6) as fine-grained, interbedded, white and grey silica and siliceous buff coloured siderite. Siderite and pyrite occur in bands 1 inch to 2 feet wide within the iron formation (Drury 1951, p. 5).

The West Brooks Iron Range is a typical Michipicoten Iron Range which occurs at the contact of intermediate to felsic metavolcanic rocks of cycle one and intermediate to mafic metavolcanic rocks of cycle two. The range occurs on the south limb of the Centre Anticline and has likely underwent considerable deformation during folding and perhaps overturning.

To the east, the West Brooks Iron Range correlates with the Central Brooks Iron Range and to the west the range likely correlates with the Reynolds Iron Range.

LAKE SUPERIOR CORPORATION (ALGOMA STEEL CORPORATION LIMITED)

E.L. Goodwin (1912a, p.2, 3) prospected this iron range and confirmed the presence of siderite and pyrite. The iron formation is described by Goodwin (1912a, p.2) as granular, massive and banded. The range was estimated to be 3/4 mile long and to contain several lenses of siderite, the largest of which was estimated to be 400 feet long and 10 to 20 feet wide (Goodwin 1912a, p.2). The West Brooks Iron Range is the same as Goodwin's Brooks Iron Range No.3 (McKee 1950, p.2). No further work was done on the range by the company.

JALORE MINING COMPANY LIMITED

The Jalore Mining Company Limited staked the iron range in 1949 and in 1950-1951 undertook a program of geologic mapping (Drury 1951, p.1; Webber 1950c; McKee 1950). In 1950, the company completed 12 short diamond drill holes on the iron range totalling 1,457 feet (AFRO). Drill holes WB-2 and WB-4 (see Figure 53) confirmed the presence of minor siderite on the north side of the iron formation (AFRO). No additional work has been completed.

LECLAIRE TOWNSHIP

During mapping of Leclaire Township numerous samples of altered rock and iron formation were taken for assay. One sample of banded chert, magnetite, wacke iron formation from the South Evans Creek Iron Range returned 0.02 ounces Au per ton. All other samples were lower in gold content. The position of this sample is indicated on the accompanying compilation map for LeClaire Township.

ACME OIL AND GAS COMPANY LIMITED (28)

In 1966, Acme Oil and Gas Company Limited had a 3 year option from the Algoma Central Railway on the land holdings of the company in the Michipicoten area (AFRO).

The company completed airborne magnetic and electromagnetic surveys over the optioned area which included LeClaire Township. The company completed follow-up diamond drilling on two electromagnetic conductors referred to as grid 4 and grid 1 (AFRO).

ACME OIL AND GAS COMPANY LIMITED DRILL HOLES 7, 8, 9 AND 10 (28-A)

Acme Oil and Gas Company Limited drilled 4 holes on its grid No.4 in west central LeClaire Township (AFRO). The logs indicate the conductor is caused by graphite and minor pyrrohotite and pyrite (AFRO). Traces of chalcopyrite were noted in all holes but No.10 and local sulphide concentrations up to 50% were reported in hole No.8 (AFRO) The best assay was hole 8 from 39.0 to 41.9 feet which returned 0.07% Cu and 0.60% Zi (AFRO). One gold assay on hole 8 and one in hole 9 indicated nil values in gold. Total footage for the 4 holes is 527.0 feet. A ground electromagnetic survey was completed over the conductor (AFRO).

The drill logs indicate the dominant host lithology is intermediate to mafic metavolcanic rocks.

ACME OIL AND GAS COMPANY LIMITED DRILL HOLES 16 AND 17 (28-B)

In northeastern LeClaire Township the company completed hole 17 and abandoned hole 16. Total footage was 232.0 feet. The company completed an electromagnetic survey over the conductive zone. Records for hole 17 could not be found (AFRO).

ALICE LAKE IRON RANGE (29)

The Alice Iron Range extends from Iron Knob in a south direction along the east side of Alice and Eva lakes. On the basis of mapping and airborne geophysics the Alice Lake Iron Range has a strike length of approximately 1310 m. Maps on file in AFRO (Toronto) indicate the iron formation is discontinuous and relatively narrow. It is unknown as to who discovered this range but the Magpie Iron Range which joins with the Alice Lake Iron Range at Iron klnob was being developed for production in approximately 1909.

The Alice Lake Iron Range is poorly exposed but locally outcrops on the ridge along the east side of Alice and Eva Lakes.

To the west of the iron formation, the rocks are a intermediate to felsic breccia. The fragments are very fine-grained, up to 0.3 m in size and angular to subrounded. The matrix is fine-grained, chloritic and contains abundant fine-grained disseminated magnetite. The matrix often weathers subdued with respect to clast. The clasts are uniform in texture and composition. As the iron formation is approached the intermediate to felsic breccia becomes increasingly iron stained.

Outcrop east of the iron range is poor. At the north end of the range, the rocks are intermediate to mafic in composition and at the south end they are intermediate to felsic. Shearing is common and the relationship of the rocks to the iron formation along the east side is obscure.

The iron formation consists of fine- to medium-grained massive magnetite with minor to abundant pyrite. In some specimens the pyrite displays a branching or anastomosing pattern strongly reminescent of sulphide structures observed in the siderite at the Lucy pit, Lucy Iron Range (Sage 1987a). The Alice Lake Iron Range joins directly with the Magpie Iron Range, which is composed of siderite at Iron Knob. In addition the rocks near the Alice Lake Iron Range appear to be lower in carbonate and contain possible traces of garnet implying a slightly higher degree of metamorphism than the typical regional lower greenschist facies. Granodiorite outcrops at a small lake in the approximate centre of the iron range and occurs in a series of outcrops approximately 1000 m east of the iron range near the Holiday - Bingham galena occurrence. These granodiorite outcrops may indicate a granodioritic mass at depth which may have supplied the thermal energy required to convert siderite to magnetite. In the Wawa area magnetite defines broad aureoles of contact metamorphism wherever siderite is cut by diabase dikes.

In the authors opinion, the magnetite of the Alice Lake Iron Range is the metamorphic equivalent of a typical Michipicoten-type siderite iron formation. The Alice Lake Iron Range is the metamorphosed on strike continuation of the Magpie Iron Range.

On the basis of stratigraphy the Alice Lake Iron Range may face northeast and along with the Magpie Iron Range define a minor fold structure on the south limb of the Centre Anticline. An alternate interpretation is that intermediate to felsic volcanism interrupted iron formation deposition just prior to onset of intermediate to mafic volcanism. The second interpretation puts the rock distribution in the proper sequence without the need for folding. The lack of facing data prevents through structural interpretation of the area.

Collins and Quirke (1926, p.97, 98) reported assays on drill core from the Alice Lake Iron Range. On the basis of the quantities of lime, magnesia, alumina and manganese, they suggested the magnetite was converted from siderite (Table 31). The author concurs with this interpretation on the basis of: sulphide structures in the magnetite. The assays reported by Collins and Quirke (1926) are presented in Table 31 and they show a composition with respect to the non volatile components that is comparable with siderite (Collins and Quirke 1926 p.69).

LAKE SUPERIOR CORPORATION (ALGOMA STEEL CORPORATION LIMITED)

Between June 1910 and June 1911 8 diamond drill holes totalling 4,862.0 feet were completed on the iron range along with extensive trenching. This work is compiled on Figure 55. This work has indicated that the Alice Iron Range consists of a series of disconnected lenses. Palmer (?) described individual lenses as indicated on Figure 54.

Collins and Quirke (1926, p.97) and Lindeman and Bolton (1917, p.76) prepared very brief summaries of this work.

JALORE MINING COMPANY LIMITED

Drury (1950a) described geological mapping of the iron range but the maps resulting from this work could not be located. The widest exposed zone of magnetite seen by Drury (1950a, p.3) was reported to be 30 feet. Drury (1950a, p.3) described the iron formation as being mixed with pyrite and chlorite with these minerals locally composing up to 35% of the iron formation. Some of the magnetite is very siliceous and has a conchoidal fracture (Drury 1950a, p.3).

Drury (1950a, p.3) reported the iron range to consist of banded silica, siliceous magnetite, leached granular silica, chlorite and magnetite on the east side of the range but this was not confirmed in the present mapping. The position of the silica described by Drury (1950a) is consistent with an east facing of these units suggested by the author on the basis of stratigraphy or rock distribution. This interpretation suggests the presence of yet undefined folding in the area since the indicated facing direction is opposite to what it should be at this position on the Centre Anticline.

Drury (1950a, p. 4) reported that two right-lateral, 280 trending faults cut the iron formation at the north and south ends of Alice Lake.

There has been no subsequent work on this iron range.

GODON LAKE IRON RANGE (30)

The Godon Lake Iron Range occurs east of Godon and Pashoskoota Lakes and is a typical Michipicoten type iron formation. The Godon Lake Iron Range extends south from the axial planar fault along Evans Creek between Pashoskoota and Rainbow Lakes, to a position approximately 390 m east of Godon Lake where it is faulted and cut off by a diabase dike. A strike length of 1530 m is indicated. To the north the Godon Lake Iron Range merges with the South Evans Creek Iron Range and to the south the faulted extension is the Reynolds Iron Range.

It is unknown as to who discovered this iron formation but prospectors, working for the Lake Superior Corporation were likely prospecting at the range in 1910 or 1911. Bell (1905, p.331) was aware of this iron range several years before it was examined by the Lake Superior Corporation. Hasselbring (1912b) described trenching on this iron range during 1912 which the author assumes would have taken place shortly after discovery.

On the east side of the iron range, the rocks are intermediate to felsic metavolcanic rocks consisting of sericite schists and massive units. On the west side of the iron range the rocks are intermediate to mafic metavolcanic rocks consisting dominantly of massive and tuffaceous units. Exposures of pillowed intermediate to mafic metavolcanic rocks on Godon Lake give consistent southwest-facing data which is in agreement with the facing direction indicated by the stratigraphy of and surrounding the Godon Lake Iron Range. Sideritic iron formation occurs on the east side of the iron formation and the more silica-rich portions are on the west side.

On the basis of mapping by the field party and the records of the Algoma Steel Corporation the iron formation is cut by a number of minor left lateral faults. The Godon Lake Iron Range is poorly exposed and does not form a prominent ridge. The simplified geology with accompanying drilling as compiled from the records of the Algoma Steel Corporation are illustrated in Figure 56.

The few outcrops observed by this field party would be best described as a siliceous gossan.

Vishnupada (1962, p.1) described the iron formation as brecciated bands of silica with a siderite matrix.

Goodwin (1953b, p.28) described the presence of siliceous siderite within the iron formation in widths up to 77 feet along the east side of the Godon Lake Iron Range for which he reported an average composition of 30.7% iron and 21.9% silica. Goodwin (1953b, p.11) reported that the Godon Lake Iron Range has a relatively constant width of 200 feet.

LAKE SUPERIOR CORPORATION (ALGOMA STEEL CORPORATION LIMITED)

Between 1910 and 1914, the Lake Superior Corporation completed trenching on the Godon Lake Iron Range and recognized the presence of siliceous siderite (Hasselbring 1912b; Goodwin 1953b, p.28).

ALGOMA STEEL CORPORATION LIMITED

Between 1953 and 1954 the Algoma Steel Corporation completed geologic mapping and drilled 7 diamond drill holes into the Godon Lake Iron Range. Diamond drill logs for this drilling could be located only for hole number 7. On the basis of plan maps this drilling totalled an estimated 3,181 feet. All holes were drilled at 45| and the data on this drilling is tabulated in Table 32. Drill hole No.1 contained an average of 0.83% manganese and had a loss on ignition of 11.34% (AFRO).

The drill log for hole 7 indicates a chert breccia cemented with siderite, pyrite and minor pyrrhotite (AFRO). Some sections are described as bedded with siderite, magnetite and sulphide bands composing up to 40% of the unit. The iron formation becomes increasing siliceous to the west towards the stratigraphic top.

HOLIDAY - BINGHAM GALENA OCCURRENCE (31)

This showing consists of two sites is on and adjacent to Parcel No.2267 east of Bingham Lake (local name) in southeastern LeClaire Township. The two showings have been described on and adjacent to the above parcel and were relocated during the present survey. There has been extensive pitting on the showings but the pits were partially filled and moss covered. Coarse-grained quartz, fluorite, pyrite and galena were picked up from some of the rubble near the old trenches. The mineralization is more typical of vein mineralization found in the western Cordillera than in the Canadian Shield. It is not recorded as to who originally found these showings. Holliday (?) reported the presence of chalcopyrite, sphalerite, copper glance (chalcocite) bornite, malacite, bismuth, molybdenite, native copper and a unknown mineral. With the possible exception of chalcopyrite the presence of the other minerals could not be confirmed.

The most northern group of trenches were located within intermediate to massive mafic metavolcanic rocks with minor units of sericite schist. Quartz veining exposed in trenches had a trend of 105| with a vertical dip. In addition to massive barren vein quartz, pyrite, galena and fluorite were recovered from the muck around the pitting and trenching. Some carbonate alteration is present in the host rocks to the veins and locally is very intense. The maximum gold value obtained was 0.02 ounces per ton on 7 grab samples of vein material (Geoscience Laboratories). Four samples returned less than 0.10 ounces Ag per ton and the remaining three returned 0.10, 0.18 and 0.52 ounces Ag per ton (Geoscience Laboratories).

The southern group of pits and trenches occur within intermediate to felsic metavolcanic rocks consisting of quartz - feldspar crystal tuff, polymictic lapilli tuff and medium-grained granodiorite. Galena, pyrite, calcite and quartz make up the vein material. One vein was measured trending 080| with vertical dip. The metavolcanic rocks and granodiorite displayed carbonate alteration. The maximum value in gold content on 5 grab samples of vein material was 0.01 ounces per ton (Geoscience Laboratories). All 5 samples returned less than 0.10 ounces Ag per ton.

Holliday (p.4) indicated silver is present in values up to 27 ounces in grab samples of galena from vein No.4 and that coarse gold is present. The location of vein No.4 is unknown.

INTERNATIONAL CORONA RESOURCES LIMITED (45)

As a follow up to an airborne magnetic and electromagnetic survey completed in 1983 Manwa Exploration Services briefly ground checked a number of conductive zones in LeClaire Township (Neelands et al. 1984a, 1984b).

Approximately half the conductors examined were not identified. Those located along the west side of the township were exclusively graphitic, pyritic, metasedimentary horizons and one in the centre of the township was reported to be iron formation (Neelands et al. (1984a). The conductors are tabulated in Table 33 and their approximate location indicated on the compilation map for LeClaire Township.

MAGPIE IRON RANGE (32)

The Magpie Iron Range and Magpie Iron Mine played a major role in the industrial history of the Michipicoten area. The mine produced siderite iron ore and the technique of sintering the ore to upgrade the iron content was developed at this mine site. The Magpie Mine is an industrial historical site and the technology developed at the mine site is now in use at the Sinter Plant in Wawa which treats siderite ore from the Helen Iron Range.

Essentially nothing remains at the former Magpie Mine site other than rotting boards and concrete foundations. Plates 19a to 19f show the mine site at the peak of development.

The name of the discover of siderite iron formation of the Magpie Iron Range apparently was not recorded.

Anonymous (1910, p.1) reported that 6 claims SSM 1038, 1041, 1042, 1045, 1047 and 1048 were staked in the summer of 1909 when the Algoma Central Railway Land Grant Area was thrown open for the staking of discoveries made before withdrawal of the area for exploration. This staking was on behalf of Messrs A.B. Blackinton, Angus Gibson and Morton J. Burke and covers the mine site (Anonymous 1910, p.1). Other claims were staked in the fall of 1909 for the Algoma Central and Hudson Bay Railroad Company (Anonymous 1910, p.1, 2). The first 6 claims were optioned to the Lake Superior Iron and Steel Company in the summer of 1909 (Anonymous 1910, p.2).

The Magpie Iron Range is unusual in that it consists essentially of only siderite or the bottom facies of the typical Michipicoten-type iron formation. The upper sulphide, chert, magnetite and graphitic facies are absent.

On the basis of its largely monomineralic nature and appearance, Parsons (1915, p.199) classified the iron formation as a vein. Leith (1916b, p.2) classified the siderite as a sedimentary bed lying between a series of felsic and mafic flows. He based his conclusion on the following observations (Leith 1916b, p.3).

1. The considerable strike length and direct connection with the Alice Iron Range.
2. The carbonate bed is conformable with enclosing mafic and felsic volcanic flows.
3. The Magpie carbonate is similar to the Helen Iron Range siderite which was considered to be a sediment by Leith.
4. The observation that carbonate is common in Lake Superior iron ranges.

The Magpie Iron Range has a strike length of approximately 2,100 feet and a width varying between 40 to 60 feet (Collins and Quirke (1926, p.95). The range strikes west from Iron Knob where it bends sharply south and becomes the Alice Iron Range. The iron range dips steeply north 80 to 90| on the basis of cross-sections prepared by C.K. Leith 1916 (AFRO). The cross-sections (AFRO) also indicate a formation that pinches and swells rapidly in the vertical diamension. Since it is a stratiform unit it likely extends to considerable depth however one would expect wide variations in thickness between levels in any development program based on old records from the mine (AFRO). The west end of the range extends to just west of the large diabase dike that cuts the Magpie Iron Range and other, short, faulted segments of the iron formation occur to the northwest. These iron formation units are part of the Magpie Iron Range which have been most likely offset by right lateral faulting even though evidence for these faults was not directly observed on the ground by the mapping party. The presence of this faulting has also been suggested by Leith (1916b, p.2).

The iron formation becomes magnetite-rich to the east where it merges with the Alice Iron Range and to the west, the magnetite content also increases (Leith 1916b, p.4). The central portion of the iron range contains the least magnetite. The presence of magnetite decreases the value of the ore since sintering cannot improve the iron content.

On the north, the siderite lies in sharp contact with a narrow unit of chlorite schist containing disseminated pyrite. Exposures of this unit can be observed in the foundation of the former ore bridge over the stock yard. Northwest and north of the chlorite zone the metavolcanic rocks are of more intermediate to felsic composition than usual for rocks overlying Michipicoten-type iron formation and rock chemistry indicates many are dacite in composition. The rocks were dominantly massive with only one or two thin interbeds of polymictic mafic tuff. These overlying felsics may be faulted into their present position prior to folding.

Along the road into the mine site and close to the mine Goodwin (1953a) mapped several outcrops as pillowed felsic metavolcanic rocks. The outcrops were re-examined by members of this field party. While there is no complete agreement on interpretation of the structures observed, the interpretation is that one is looking at chloritic alteration along polygonal cooling cracks within a silicified intermediate to mafic flow.

Along the south side of the iron formation a distinctive volcanic breccia is present. This breccia is well exposed in outcrops south of Mud Pond (local name), along the north side of Beaver Lake (local name) and in railway cuts immediately south of the mine site. The breccia is oligomictic, lacks stratification and contains blocks up to 1 m across. Most fragments are 0.3 m or less in maximum dimension. The rock is buff, pale pink, to orange pink in colour with the clast cores commonly being grey or bluish grey. The breccia is very hard, splintery when hammered and may display a crude subconchoidal fracture. The toughness of this breccia is unusual for the Wawa area and on the basis of its field appearance the author suggested the area had undergone silicification (Sage 1983). The chemical data given in this report for the various types of alteration indicates a depletion in magnesium and potassium and addition of calcium and sodium within these breccias. The fact that a large number of clasts have darker cores than rims implies to this author that the present felsic composition does not likely represent the original.

Exposed in the foundation of the former ore bridge north of the ore horizon is a very fine-grained intermediate to felsic rock which appears similar if not identical to intrusive rocks observed in Abotossaway Township. Contacts with other rock types were not observed. For simplicity in map making this possible hypabyssal intrusion was placed on the accompanying map as a massive flow.

Within the workings of the mine, a rock referred to as a "mica dyke" was encountered on the third level (Collins and Quirk 1926, p.96). Leith (1916b, p.4, 5) reported that this dike reduced the quantity of ore on this level by 36.5% and that drilling below this level indicated a widening of the dike with depth. This intrusive mass increased in volume downward having an exposed length of 150 feet on the fourth level (Booth 1952, p.1). Below the fourth level on the fifth level the micaceous mass was absent but found 30 feet above the level (Booth 1952, p.1). On the waste dump of the mine "mica dike" material consists of fine- to coarse-grained chloritized biotite with fine-grained carbonate. Elliptical lense-like masses of carbonate up to 25 cm in length occurred in some samples.

The siderite along both contacts of the diabase dike at the west end of the iron range has been converted to magnetite as a result of thermal contact metamorphism. Leith (1916b, p.4) indicated this thermal contact zone to be approximately 25 feet in width. The conversion of the siderite to magnetite renders the ore worthless as feed to the sinter plant and this material was never mined.

The geologic structure of the rocks within the mine area is unclear due to the lack of good facing data. On the basis of analogy with stratigraphy in other parts of the Wawa supracrustal rocks, the Magpie Iron Range along with the Alice Iron Range may define a minor fold on the south limb of the Centre Anticline. West of the west end of the Magpie Iron Range the author suspects numerous more or less conformable strike-slip faults are present to account in part for the termination of the iron range and northwest-striking ridge-like outcrop pattern.

The uniqueness of the Magpie Iron Range warrents some comment. The absence of the upper facies of iron formation could result from the reactivation of volcanism before siderite deposition was complete. The stratigraphically a higher facies of iron formation may now be represented in the Reynolds and Godon Lake iron ranges. The possibility of renewed volanism before iron formation deposition was completed was originally proposed by Young (1953, p.25, 26). The author has independantly came to a similar conclusion.

Richter (1952, p.52) and Young (1953, p.25) reported the presence of a narrow band of silica with the siderite in the extreme western end of the range. This banded chert was not located by the field party.

The ore is described as a very fine-grained, hard dense, buff, grey to pale yellow carbonate sprinkled with pyrite (Lindeman and

Bolton 1917, p.38; Ontario Iron Ore Committee 1924, p.160; Collins and Quirke 1926, p.95). Magnetite is a common accessory and the ore becomes increasingly blacker as the magnetite content increases (Lindeman and Bolton 1917, p.38; Ontario Iron Ore Committee 1924, p.160).

The quantity of siderite produced by the Magpie Mine is unknown. Tonnage figures available to the author do not agree and the reader may wish to refer to (AFRO; Lindeman and Bolton 1917, p.38; Ontario Iron Ore Committee 1924, p.160). The most complete listing is by the Ontario Iron Ore Committee (1924, p.160) which gives the tons of ore shipped each year. However the mine did not ship ore but shipped sinter and the quantity of siderite needed to produce the sinter shipped is much greater. Leith (1916b, p.7) reported that 1.43 tons of raw ore are required to produce 1 ton of sinter and Collins and Quirke (1926, p.96) stated that 2,800 pounds of siderite are needed to produce a ton of sinter.

The Ontario Iron Ore Committee (1924, p.160) indicated 1,193,480 tons of ore (sinter) were shipped from the mine. Using the ratios given by Leith (1916b) and Collins and Quirke (1926) this translates to 1,706,676 or 1,670,872 tons of raw siderite respectively indicating the mine may have produced approximately 1.7 million tons of siderite. An additional complication exists in that ore from the Helen Mine in the Helen Iron Range was shipped to the Magpie sinter plant for treatment (Hasselbring 1916, p.5; Anonymous 1919, p.6). Therefore the amount of ore (sinter) shipped from the Magpie Mine as noted by the Iron Ore Committee (1924, p.160) may be inflated since there is no published record that the siderite production of the two mines was kept separate. It seems likely that the quantity of siderite mined from the Magpie Iron Range did not greatly exceed 1.5 million tons.

Berdusco (MacLeod Mine, Algoma Steel Company Limited, personal communication 1987) cited unpublished data in the files at the MacLeod Mine as indicating 168,000 tons of raw ore were shipped from the Helen Mine between 1913 and 1921 for sintering at the Magpie Mine. Using 1.4 tons of raw ore for each.PA ton of siderite. This would produce 120,000 tons of sinter which subtracted from total sinter shipped leaves 1,073,480 tons of sinter from Magpie Mine ore. Converting from sinter to raw ore indicates the mine produced 1,502,872 tons of siderite.

A reserve of 750,000 tons is given in AFRO (Toronto), however, Anonymous (1921, p.5) indicated a developed or partly developed reserve of approximately 300,000 tons in March 1921. The mine closed on March 8, 1921 (Iron Ore Committee 1924, p.160). Under present economic conditions and the examination of existing data on the property there is not likely to be any interest in the iron potential of the Magpie Iron Range in the near future.

During the early stages of development the ore reserves at the Magpie Mine were estimated at 7,000,000 tons (Hardman 1910, p.8). Later Hasselbring (1916, p.2, 3) revised them downward to 5,000,000 and Leith in (1916, p.9) revised the tonnage to 634,900 tons effective January 1917.

As development preceeded and the "mica dike" intrusion was encountered, Leith (1916b, p.9) reported that only 784,900 tons remained in the mine in 1916 above the fourth level and that originally only 1,305,900 tons were actually present at the start of mining. The quantity of siderite in place at the start of mining was greatly over estimated.

Samples of the Magpie siderite were collected from the area of the former roasting plant and their base and precious metal contents determined. These data are given in Table 34 and indicate no significant base or precious metal contents.

HISTORICAL RESUME

A large number of references exist on the Magpie Mine which the reader should be aware of if contemplating work in the area. These relate to exploration, development and processing of the Magpie siderite. The reader may wish to refer to Melville (1911); Corkill (1911, 1912, 1913); Sutherland (1914, 1917, 1918, 1919, 1920, 1921, 1922) and Hasselbring (1917) who described the mining methods used at the Magpie Mine. The Ontario Iron Ore Committee (1924) give a good description of the sintering process.

LAKE SUPERIOR CORPORATION (ALGOMA STEEL CORPORATION LIMITED)

The Ontario Iron Ore Committee (1924, p.160) prepared a good historical summary of the Magpie Mine. This summary is as follows:

"The claims comprising the Magpie mine property were staked in 1909 on several showings of magnetite. Exploration by trenching, stripping, test-pitting and diamond drilling was undertaken the same year and was continued till the fall of 1910, this work showing the deposits to consist essentially of siderite, portions of which had been altered to magnetite. In 1910 the sinking of a four-compartment shaft was commenced and in 1911 the erection was undertaken of a roasting plant for the production of a marketable ore from the siderite, which had been shown to have an iron content of about 35 per cent and an objectionable amount of sulphur. The roasting plant was put in operation in December, 1912 and was operated till October, 1913, when it was dismantled to be replaced by a plant designed along lines suggested by the experience of the previous ten months. The new roasting plant went into operation in May, 1914 and continued till October 31st, when mining operations were suspended indefinitely on account of the depression in the iron and steel trade. In May 1915, mining operations were resumed and the roasting plant, with some modifications, was again put in commission. The Magpie operations were discontinued on March 8th, 1921. Since that time the mine has remained closed down".

Other analytical data presented by the Ontario Iron Ore Committee is given in Table 35.

The total footage drilled in 1909 and 1910 was 7,224.2 feet (AFRO). These data are given on Figure 57 along with an outline of the siderite iron formation. The main production shaft reached a final depth of 611 feet and development of a 5th level was in progress shortly before mine closure (Sutherland 1921, p.65).

JALORE MINING COMPANY LIMITED

In 1951, the Jalore Mining Company Limited completed detailed geologic mapping of the Magpie Iron Range (Richter 1952, p.51, 52). No record of this work could be found.

ALGOMA STEEL CORPORATION LIMITED

In 1952 and 1953, the Algoma Steel Corporation Limited completed four diamond drill holes below the mine workings to test the downward continuation of the siderite horizon. This drilling totalled 5,512 feet (AFRO). Drill hole one encountered 3 feet of magnetite at a vertical depth of 1000 feet and hole 2 encountered 15 feet (true width) of siderite at a vertical depth of 900 feet (AFRO). This 15 foot section assayed 43.37% iron, 9.66% sulphur and 16.05% silica (AFRO, Toronto).

Hole number 3 failed to reach iron formation and hole 4 had two intersections; one of 5 feet and a second one of 12 feet (AFRO). The second and widest intersection was at a vertical depth of 900 feet and returned 35.2% iron, 5.6% sulphur and 12.9% silica (AFRO). No additional work has been completed on the Magpie Iron Range.

MASON-WILBUR PROSPECT

A report dated 1921 in AFRO (Toronto) indicates a drill hole totalling 510 feet was completed in the north east corner of claim 163 below a large diabase dike. This claim is referred to as the Mason-Wilbur prospect. The location of this claim is unknown.

MCGOWAN, R.J.

Mr. R.J. McGowan had 13 claims that covered the area between the east end of Reynolds Lake and the east side of Punk Lake. The claims covered a large segment of the Reynolds Iron Range and is underlain dominantly by massive and pillowed intermediate to mafic metavolcanic rocks. Magnetometer and VLF-EM surveys were run over the property and the iron formation traced across the property (Reid and Sears 1984b, p.16). Seven conductive horizons were identified and interpreted to be dominantly associated with iron formation (Reid and Sears 1984b, p.20).

The claim group was mapped at a scale of 1 inch to 75 feet disclosing an iron formation of highly variable width and thin units of intermediate to felsic and intermediate to mafic metavolcanic rocks (Neelands 1984). Mapping by the author in this area indicated locally highly fissill rocks and rapid lithologic changes which may be due to stacking and intercalation of units by strike-slip faulting. Neelands (1984) reported that grab samples of mineralized rock were taken for geochemical analysis for gold and base metals but the results were not encouraging. Additional work was recommended but not completed.

NORANDA EXPLORATION COMPANY LIMITED (33)

In 1979 the Noranda Exploration Company Limited completed an airborne magnetic and electromagnetic survey over LeClaire, Musquash, Aguonie and Bird townships (MacLeod 1979; Wakeford and Waddell 1981).

The company cut 6 grids in LeClaire Township over areas referred to as A, C, D, 1-81, 1-80, 2-81 (Wakeford and Waddell 1981). "A" is the North Evans Creek No.3 Iron Range, Grid "C" is the anomaly previously drilled by Acme Gas and Oil Limited (28-A); Grid "D" occurs within intermediate to mafic metavolcanic rocks at the north end of Punk Lake.

Grid 1-80 occurs in the same area as Acme Oil and Gas Limited Grid 1 (28-B). Grid 1-81 occurs within intermediate to mafic metavolcanic rocks and iron formation at the east end of the South Evans Creek Iron Range and Grid 2-81 occurs along the Godon Lake Iron Range.

The company completed electromagnetic and magnetic surveys over the grids and geological surveys over all grids but 2-81. Wakeford and Waddell (1981, p.11) indicated 3 and possibly 4 conductors east of Punk Lake on Grid "D" were all due to magnetite iron formation.

On anomaly 1-80, ground work identified 3 conductors, 2 of which are magnetite iron formation and the third conductor was diamond drilled (Wakeford and Waddell 1981, p.11).

A number of conductors on grid 1-81 were identified as graphitic shears within intermediate to mafic metavolcanic rocks and one large conductor was associated with Michipicoten type iron formation of the South Evans Creek Iron Range (Wakeford and Waddell 1981, p.11). On grid 2-81, several weak minor conductors paralleled the main conductor consisting of Michipicoten type iron formation of the Godon Lake Iron Range (Wakeford and Waddell 1981, p.12). These weak conductors were not identified.

NORANDA EXPLORATION COMPANY LIMITED DIAMOND DRILL HOLE 1-81 (33-A)

On grid 1-80 the company completed 1 diamond drill hole to a depth of 200 feet (AFRO). This hole was drilled to test a weak conductor which was identified as conductive pyrrhotite bands in mafic tuff between 125 and 159.5 feet (AFRO). The company reported nil gold and silver values from the conductive section but did get a value of 0.002 ounces Au per ton from a sample of mafic tuff from 52.0 to 57.0 feet (AFRO). The drill results were not encouraging and the company completed no additional work.

NORTH EVANS CREEK IRON RANGE (34)

The North Evans Creek Iron Range occurs north of Evans Creek and is composed of three segments labelled Evans Creek 2, 3 and 4. Outcrop of the iron formation and enclosing rocks is rare. Magnetic attraction is strong over the iron formation and the few observed outcrops consist of iron stained chert or thin bedded chert and magnetite.

The three segments of iron formation making up the North Evans Creek Iron Range were likely once connected and occur at roughly the same stratigraphic position. The iron formation cannot be traced west of the present mapping on the basis of existing data but may be correlative with the Brant Iron Range to the west. To the east Goodwin (1953b, p.30) has indicated a geophysically inferred iron range as the Rutledge just east of the Marsden fault which may be equivalent. This iron range is segmented but geophysically traceable from the northwest corner of Abotossaway Township to the southeast corner of Dunphy Township where it is known as the Dreany Iron Range. The Dreany Iron Range is a major stratigraphic unit in southeastern Dunphy Township and eastward across the McVeigh Creek fault into Finan Township.

The North Evans Creek Iron Range and the Dreany Iron Range occur within intermediate to mafic tuffs at the top of cycle two mafic volcanism or at the base of immature metasedimentary rocks of Dore type. Collins and Quirke (1926, p.98) observed that the North Evans Creek Iron Range occurred south of well-bedded metasedimentary rocks of the Dore series. The iron formation was reported to dip south at 60| and be approximately 175 feet thick (Collins and Quirke 1926, p.98). Collins and Quirke (1926, p.98) described the iron formation as consisting of grey siliceous laminae one half inch thick with shining black laminae containing large quantities of magnetite.

It is not known who discovered this iron range but it is assumed that it was extensively prospected around 1909 when prospecting of iron formation in this township was intense. Algoma Steel Corporation Limited

In 1953 and 1954, the Algoma Steel Corporation Limited completed an aerial magnetic survey of LeClaire Township (Khan 1973, p.1). The company outlined the strong aeromagnetic anomalies representing the North Evans Creek Iron Range and follow up mapping, dip needle surveys and trenching were completed.

On Evans Creek No. 4 in the extreme northwest corner of the township Goodwin (1953b, p. 24) described an iron formation unit as being 2,000 feet long and varying from 100 to 150 feet in width. One chip sample at a 5 foot spacing across 150 feet returned 13.9% iron, 74.78% silica and 0.36% sulphur (Goodwin 1953b, p.29).

The Evans Creek No. 3 segment is described by Goodwin (1953b, p.29) as 3,600 feet long and averaging 200 feet in width at surface. Plan maps indicate 8 diamond drill holes were completed in this segment of iron formation but logs for only 7 could be located (AFRO). On the basis of the drilling, Goodwin (1953b, p.29) indicated a width of 150 feet. Goodwin (1953b, p.29) indicated that the Evans Creek No. 3 averages 16.5% iron and 63.6% silica and that a selected width of 57 feet in hole number one averages 30.05% iron, 46.8% silica, 0.41% sulphur and 0.056% phosphorous.

The log for hole number 7 could not be located but the indicated position of this hole on drilling plan maps suggests that hole 6 was drilled in the same direction and directly below hole 7. The logs for the 6 confirmed drill holes total 2,826 feet (AFRO). A reference to hole 7 in AFRO (Toronto) indicates it had a depth of 616 feet bringing total footage to 3,442 feet.

Evans Creek No.2 lies just south of Sawmill Lake (local name). Goodwin (1953b, p.29) indicated the range has a length of approximately 2,000 feet and a average width of 200 feet. This segment of iron formation was penetrated by two diamond drill holes (holes 9 and 10) totalling 1,367 feet (AFRO). Goodwin (1953b, p.29) reported that a 60 foot section of this iron range averages 16.5% iron and 62.8% silica.

The Evans Creek No. 1 is part of South Evans Creek Iron Range and is discussed under that property description.

The drill logs for No.2 and No.3 Evans Creek indicate a banded chert magnetite iron formation with rare graphitic seams (AFRO). Pyrite or sulphide content is minor and siderite is absent. The North Evans Creek Iron Range is not a Michipicoten-type iron formation.

REYNOLDS IRON RANGE (35)

The Reynolds Iron Range was likely prospected during 1909 and 1910 when prospecting for iron formation in this region was intense but was known by Bell (1905, p.332) prior to this time. The range strikes southeasterly from the fault east of Godon Lake where it joins with the Godon Lake Iron Range. The range crosses LeClaire Township and crosses the northeast corner of Musquash Township where it tapers out near the east boundary of Musquash Township. The southeast end of this iron range most likely correlates with the west end of the West Brooks Iron Range in Corbiere Township.

The mapped strike length is approximately (9,360 m in length and Richter (1952, p. 54) indicated a length of approximately 26,500 feet. The differences in strike length is likely dependent on where one determines the beginning and ending of the range. Richter (1952, p.54) indicated an average width of 100 feet for the Reynolds Lake Iron Range but the range pinches and swells greatly.

Collins and Quirke (1926, p.48) reported widths of 200 feet near its northern end and 300 feet southeast of the Magpie River. Mapping by Neelands (1984) indicated a width of 0 to 312 m east of Punk Lake.

Where encountered in the field the range consisted of iron stained banded chert with minor magnetite. Pyrite and pyrrhotite were occasionally encountered on the northeast side of the iron range west of Eva Lake. Collins and Quirke (1926, p.98) reported the presence of siderite but no siderite was observed in outcrop on this range during the present survey. Siderite does occur at the base of the Godon Lake Iron Range which is the on strike continuation of this iron range.

There is more than one iron formation unit between Punk and Eva Lakes and the author interprets this distribution of iron formation to result from strike slip movement and stacking of a once continuous iron formation unit prior to folding. This shearing has obliterated original stratigraphy in this area. As previously mentioned, the Reynolds Iron Range may represent the upper facies of a typical Michipicoten type iron formation separated by metavolcanic rocks from its lower facies represented by the siderite iron formation of the Magpie Iron Range.

ALGOMA STEEL CORPORATION LIMITED (GIBSON CLAIMS (35-A)

In 1954 the Algoma Steel Corporation Limited completed two diamond drill holes on the Gibson claims which were located over the thickest section of iron formation existing on the Reynolds Iron Range. This drilling totalled 1,061 feet and indicated graphitic chert on the west side and sugary chert throughout most of the core (AFRO). Pyrite and pyrrhotite appear to increase towards the east and siliceous siderite and minor sulphide occurred in both drill holes (AFRO). The siliceous siderite is intercalated with pyrrhotite (AFRO). The drill logs indicate the presence of numerous biotite dikes.

On the drill logs the increasing sulphide and siderite content to the east indicates that the iron formation faces southwest assuming that carbonate and sulphide faces iron formation indicate the bottom of the iron formation unit. A southwest west-facing unit is consistent with facing determinations based on pillow shapes west of the iron ranges.

Goodwin (1953b, p. 27) reported that the above two drill holes suggest the presence of a lense of siderite 5 to 10 feet thick, 350 feet long, giving a partial analysis of 31.1% iron, 3.5% silica, 0.296% sulphur, 0.016% phosphorous, 1.96% manganese oxide, 1.24% calcium oxide and 2.68% magnesium oxide.

SOUTH EVANS CREEK IRON RANGE (36)

The South Evans Creek Iron Range extends from the axial planar fault along Evans Creek, this fault separates the South Evans Creek Iron Range from the north end of the Godon Lake Iron Range. The iron range is continuous from Evans Creek to just beyond the east boundary of LeClaire Township. It is unknown as to when this iron range was discovered but presumably it was prospected in 1909 and 1910 when prospecting of the iron ranges in this area was intense. This iron range has a strike length estimated as (7,330 m) and a highly variable width. The iron-formation is commonly brecciated and in outcrop consists of iron stained laminated chert. While magnetic it is not as magnetic as the North Evans Creek Iron Range which is separated from the South Evans Creek Iron Range by a strike slip fault along Evans Creek.

Collins and Quirke (1926, p.99) include part of the northern end of the Godon Lake Iron Range with the South Evans Creek Iron Range but the author prefers to use the fault along Evans Creek as the point of demarcation of the two ranges.

Collins and Quirke (1926, p.49) reported that the iron formation on the east side of an unnamed lake east of Pashoskoota Lake is 790 feet thick and highly contorted. This ridge of banded siliceous iron formation occurs on the nose of the Centre Anticline and the observed strike is due to folding and shearing. The true width of this unit is much less than the 790 feet observed in outcrop. Collins and Quirke (1926) place a fault with 1500 feet of left lateral displacement a quarter mile east of the above unnamed lake, however, mapping suggests that the iron formation continues on through this area but is folded sharply northward before again turning eastward. The iron formation is reported to be 400 feet thick east of the large outcrop on the unnamed lake.

After turning eastward, the iron formation occurs along a topographic ridge but is poorly exposed. In trenches at the east end of the range examined by Collins and Quirke (1926, p. 99) widths of 125 and 220 feet and a south dip of 50 to 60 are indicated. On the north side of the range schistose to massive intermediate to mafic metavolcanic rocks are present and on the south side the lithology is dominantly intermediate to felsic tuffs, sericite schists, feldspar crystal tuffs and breccias.

The short segment of iron formation from the unnamed lake east of Pashoskoota Lake to where it takes a sharp bend to the east has been referred to as the Finger Lake Iron Range (Goodwin 1953b, p.11).

The iron formation consists of hard, banded, silica in grey and black layers, but it is friable if granular silica is present (Collins and Quirke 1926, p.99). Collins and Quirke (1926, p.100) reported that magnetite layers two feet thick may be present.

ALGOMA STEEL CORPORATION LIMITED (36-A)

The Algoma Steel Corporation completed one drill hole on Evans Creek No.1 which is at the eastern end of the South Evans Creek Iron Range. This segment of iron formation was considered to be 4600 feet long and 250 feet wide on the base of geological and dip needle surveys (Goodwin 1953b, p.28). Goodwin (1953b, p.28) reported that the iron formation consists of thinly interbanded chert and magnetite and that a section of 200 feet wide averaged 15.0% iron, 66.3% silica and 2.1% sulphur. What composed the remaining 16.3% of the core was not reported. This drill hole is number 11 and totalled 433 feet Siderite was reported to be present in the centre and bottom of the hole (AFRO). Thin graphitic interbeds were noted in numerous places throughout the core.

UNION MINIERE EXPLORATION AND MINING CORPORATION LIMITED (37)

The Union Miniere Exploration and Mining Corporation Limited completed an airborne magnetic and electromagnetic survey over LeClaire Township in approximately 1974. This survey clearly delineated the iron formations and indicated a number of conductive horizons. The company concentrated its efforts on three areas. One area of investigation is 700 m east of Kapimchigama Lake and 400 m east of the west boundary of LeClaire Township. This was known as anomaly Wa 2-24, 25. The second area of interest was the on the east shore of Pashoskoota Lake referred to as anomaly Wa 2-22A, B and a third area 2,000 m west of Sawmill Lake known as anomaly Wa-15 (AFRO). Diamond drilling of these targets was completed in 1975 and 1976.

DIAMOND DRILL HOLE WA-3 (37-A)

Diamond drill hole Wa-3 was drilled in 1975 to test anomaly 24 and 25 and was completed to a depth of 252 feet (AFRO). The conductor was identified as graphitic shale and siltstone with thin interbeds of magnetite which may contain up to 4% pyrite, pyrrhotite and perhaps sphalerite (AFRO). Assays for Pb, Au and Ag were trace to nil, for copper 0.02% and for zinc 0.02 to 0.05% (AFRO).

The rocks enclosing the conductor were logged as interbedded siltstones and mudstones (AFRO).

DIAMOND DRILL HOLES WA-9 AND WA-10 (37-B)

These two drill holes were completed in 1976 to test anomaly Wa 2-22A, B on the east side of Pashoskoota Lake. The drilling totalled 579 feet (AFRO). Drill hole Wa-9 failed to intersect conductive material and penetrated mafic metavolcanic rocks and intrusive diorite (AFRO).

Diamond drill hole Wa-10 intersected pyrrhotite mineralization from 161.9 to 178.0 feet from 180.5 to 183.0 feet and at 209.0 feet (AFRO). Graphite was reported from 310.0 to 313.5 feet (AFRO).

In the interval 161.9 to 178.0 feet it was estimated that the rock contained 40 to 50% pyrite and pyrrhotite and within the interval of 180.5 to 183.0 feet it was estimated that 30% pyrrhotite and pyrite was present (AFRO). Assays indicate a trace to nil nickel, trace to 0.04% Cu, 0.03 to 0.08% Zi, trace to nil lead, trace to 0.01 ounces Au per ton and trace to nil silver (AFRO, Toronto).

DIAMOND DRILL HOLE WA-5 (37-C)

This drill hole tested anomaly Wa-15 in 1975 which is located north of the North Evans Creek Iron Range. The drill hole reached a depth of 298 feet penetrating mafic tuffs and then intercalated mafic-felsic tuffs at the bottom of the hole (AFRO). The conductor occurs in the top of the intermediate to mafic metavolcanic rocks or near the bottom of the Dore metasedimentary rocks. The anomaly was explained by the presence of semi-massive pyrite and pyrrhotite at 140.0 to 140.8 feet and at 141.8 to 142.1 feet (AFRO).

Assays indicate a trace to 0.01% Cu, 0.01 to 0.04% Zi, nil lead and nil silver (AFRO). One assay of 0.01 Ni was reported and no assays for gold (AFRO).

MUSQUASH TOWNSHIP

Musquash Township is underlain dominantly by intermediate to mafic metavolcanic rocks and there are no significant iron, base metal, or precious metal showings. The area of tourmaline alteration in the southeast corner of the township is anomalous in gold and warrants prospecting.

ACME OIL AND GAS COMPANY LIMITED (38)

As a follow up to a regional airborne magnetic and electromagnetic survey, Acme Oil and Gas Company Limited cut a grid in the northwest corner of Musquash Township just over 0.4 km southwest of Eva Lake. The company completed electromagnetic, magnetic and geochemical surveys and one drill hole, number 18, on the anomaly (AFRO). The hole reached a depth of 121.5 feet but no record of rocks or what was encountered could be located (AFRO). The maps or results of the geochemical and electromagnetic surveys could not be located (AFRO).

ALGOMA STEEL CORPORATION LIMITED (WAGNER ANOMALY) (39)

As a result of a airborne magnetic survey a magnetic anomaly described as having two limbs was located in eastern Musquash Township and was investigated by the Algoma Steel Corporation Limited in 1962 (Wagner 1962). The south limb of the anomaly was identified by geologic mapping as being due to iron formation of the Reynolds Iron Range and the north limb due to a gabbro intrusion (Macauley 1962). No additional work was completed.

AMAX EXPLORATION INCORPORATED (40)

Amax Exploration Incorporated compiled available airborne geophysical data from Acme Gas and Oil Company Limited and Union Miniere Exploration and Mining Corporation Limited and diamond drill tested two previously untested airborne geophysical anomalies (AFRO).

AMAX EXPLORATION INCORPORATED DIAMOND DRILL HOLE 989-09-1 (40-A)

This airborne anomaly was previously identified by Union Miniere Exploration and Mining Corporation Limited as anomaly Wa 5-12 (AFRO). Amax Exploration Incorporated cut a grid over the anomaly, referred to as anomaly 26 and completed sufficient geological and geophysical work to locate the position of the anomaly. The company completed one diamond drill hole 989-09-1 in 1980 totalling 90.5 m on the anomaly and identified 4 conductive horizons (AFRO). From 33.0 to 35.8 m an intermediate tuff containing up to 30% pyrrhotite was encountered and graphitic argillite was penetrated from 43.3 to 43.6 m, 51.5 to 54.6 m and from 60.2 to 60.5 m (AFRO). The company reported Au as nil to 0.01 ppm, Ag as nil to 0.7 ppm, Cu as 57 to 293 ppm, Pb as 33 to 55 ppm and Zn as 100 to 645 ppm on samples from the core (AFRO). The lower values were generally in the sulphide-rich horizon. The drill log indicates a mixture of intermediate to mafic massive and pillowed flows with argillite and wacke (AFRO).

AMAX EXPLORATION INCORPORATED DIAMOND DRILL HOLE 989-09-2 (40B)

This airborne anomaly was previously identified by Union Miniere Exploration and Mining Corporation Limited as anomaly Wa 5-13 and renumbered as 27 by Amax Exploration Incorporation (AFRO). Amax Exploration Incorporated completed sufficient geological and geophysical work on the ground to locate the anomaly and then in 1980 completed one drill hole totalling 108.8 m to test the anomaly (AFRO). The drill hole encountered 4 conductors at 57.0 to 60.0 m, 62.5 to 64.0 m, 65.2 to 65.8 m and 70.0 to 71.3 m (AFRO). The conductors at 57.0 to 60.0 m and 70.0 to 71.3 m were described as graphite-pyrrhotite and the remaining two as graphite conductors. Assays accompanying the drill log indicate Au varied from nil to 0.4 ppm, Ag from nil to 0.3 ppm, Cu from 68 to 272 ppm, Pb from 30 to 40 ppm and Zi from 72 to 850 ppm (AFRO). No additional work was completed. The host rocks were described as intermediate to mafic metavolcanic rocks (AFRO).

INTERNATIONAL CORONA RESOURCES LIMITED (46)

In a follow up to an airborne magnetic and electromagnetic survey completed in 1983 Manwa Exploration Services briefly ground checked a number of conductive zones (Neelands et al. 1984a). Most conductors were not identified but the two that were identified consisted of pyritic graphitic horizons (Neelands et al. 1984a). The available data is summarized in Table 36 and the reader should refer to Neelands et al. (1984a) for details.

JALORE MINING COMPANY LIMITED

The Jalore Mining Company Limited completed reconnaissance mapping of the Reynolds Iron Range in northeastern Musquash Township (Drury 1950b). No other work was completed.

REYNOLDS IRON RANGE (35)

The Reynolds Iron Range forms a distinctive unit cutting across the northeast corner of Musquash Township. This iron formation was previously described under properties in LeClaire Township.

NORANDA EXPLORATION COMPANY LIMITED

As a follow up to an airborne electromagnetic and magnetic survey over Musquash Township (AFRO), the company identified one anomaly referred to as "E" which correlates with the Reynolds Iron Range. The company cut a grid over the anomaly and completed geological, magnetic and electromagnetic surveys (AFRO). The results were discouraging and work terminated. The iron formation conductor was described as consisting of magnetite, pyrite and chert (Wakeford and Waddell 1981, p. 22). The mapping indicates the iron formation pinches and swells rapidly varying from 150 to 400 feet in width (AFRO).

UNION MINIERE EXPLORATION AND MINING CORPORATION LIMITED (41)

As a follow up to a regional aeromagnetic and electromagnetic survey, Union Miniere Exploration and Mining Corporation Limited cut a grid over a conductor noted as Wa 5-14A, B. This conductor is close to grid 17 of Acme Gas and Oil Corporation Limited. The company completed one hole Wa-11 in 1975 totalling 300.0 feet on the anomaly and identified conductive horizons from 163.5 to 170.5 feet and 232.5 to 254.0 feet (AFRO). The conductors were described as graphite and pyrrhotite-bearing mudstone and argillite. The rock types intersected were dominantly intermediate to mafic metavolcanic rocks with thin interbeds of metasediment. The deeper intersection contained 10 to 15% sulphide, however, graphite would appear to be the dominant conductive mineral (AFRO). The reported assays were nil in gold and silver (AFRO). Copper values varied from 0.01 to 0.02%, Ni from trace to 0.01%, Zn from 0.01 to 0.12% and Pb nil to trace (AFRO). No additional work was reported.

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

Conversion from SI to Imperial			**Conversion from Imperial to SI**		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
		AREA			
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
		VOLUME			
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
		CAPACITY			
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
		MASS			
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	31.103 476 8	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
		CONCENTRATION			
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

	Multiplied by	
1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.

SAGE
CHLORITOID-BEARING INT-FEL METAVOLCANIC RKS., AREA II

MAJOR OXIDE LISTING

	82RPS-0091	82RPS-0092	81RPS-0174	81RPS-0175	81RPS-0176	81RPS-0177
SiO2	61.10	54.40	71.90	70.60	71.40	63.90
Al2O3	15.00	11.10	15.70	15.40	18.60	20.50
Fe2O3	1.88	1.72	1.18	1.00	0.58	1.36
FeO	4.38	4.60	5.33	6.21	4.60	6.50
MgO	2.61	4.62	0.67	0.77	0.46	0.54
CaO	3.79	7.85	0.60	1.10	0.43	0.46
Na2O	00.00	00.00	0.39	0.42	0.45	0.83
K2O	2.31	1.10	0.44	0.30	0.58	0.46
TiO2	0.74	0.33	0.83	0.74	0.72	0.74
P2O5	0.09	0.03	0.13	0.13	0.13	0.09
MnO	0.18	0.10	0.16	0.20	0.12	0.12
CO2	5.15	11.80	0.21	1.19	0.15	0.26
S	0.47	0.01	0.01	0.01	0.12	0.03
H2O+	2.39	1.48	2.18	2.10	2.02	3.38
H2O-	0.01	0.01	0.13	0.08	0.08	0.12
LOI	6.80	13.00	1.70	2.30	1.90	3.00
TOTAL	100.10	99.15	99.86	100.25	100.44	99.29
S.G.	2.83	2.86	2.86	2.88	2.83	2.91

TRACE ELEMENT LISTING

	METHOD	82RPS-0091	82RPS-0092	81RPS-0174	81RPS-0175	81RPS-0176	81RPS-0177
Ba	AA	230	120	110	240	250	170
Co	AA	21	5	6	7	7	

							7
Cr	AA	53	24	-5	-5	-5	39
Cu	AA	38	12	10	18	24	7
Li	AA	17	6	11	4	7	14
Ni	AA	54	10	-5	-5	-5	6
Pb	AA	82	74	-10	34	52	41
Zn	AA	200	64	74	81	147	160
Be	ICP/OES	2	2	1	1	1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	11	7	11	8	11	9
Sr	ICP/OES	30	110	85	75	85	150
V	ICP/OES	90	50	30	25	24	60
Y	ICP/OES	4	5	8	4	12	5
Nb	XRF	8	8	3	-1	2	7
Rb	XRF			10	10	10	10
Zr	XRF	95	85	210	185	200	170

```
 MAJOR OXIDE LISTING

              81RPS-0178 81RPS-0180 81RPS-0181 83RPS-0220
83RPS-0221 83RPS-0222

 SiO2              77.00      69.70      42.30      46.50      49.00
    62.30
 Al2O3             14.70      15.20      12.90      15.30      14.60
    16.80
 Fe2O3              0.71       0.85       1.90       5.92       3.75
     1.18
 FeO                0.29       5.33       9.49       9.02       8.07
     4.00
 MgO               00.00       0.94       5.12       5.05       6.86
     1.21
 CaO                0.26       1.68       9.60      11.20      10.70
     3.60
 Na2O               4.09       0.38       0.35       1.69       1.03
     1.74
 K2O                1.58       0.53       0.43       0.05      00.00
     0.88
 TiO2               0.04       0.82       0.78       1.71       0.96
     0.71
 P2O5               0.05       0.12       0.04      00.00      00.00
     0.06
 MnO                0.01       0.18       0.15       0.22       0.18
     0.14
 CO2                0.32       1.36      14.30       0.32       0.22
     4.76
 S                  0.03       0.03       0.04       0.07       0.02
     0.04
 H2O+               0.88       2.39       2.66       2.41       2.97
     2.08
 H2O-               0.13       0.13       0.09       0.03       0.02
     0.09
 LOI                1.20       2.60      15.30       2.70       3.30
     6.60
 TOTAL            100.09      99.64     100.15      99.50      98.40
    99.60
 S.G.               2.88       2.85       2.96       2.85       2.83
     2.84


 TRACE ELEMENT LISTING

      METHOD  81RPS-0178 81RPS-0180 81RPS-0181 83RPS-0220
83RPS-0221 83RPS-0222

 Ag    AA                                              -2         -2
       -2
 As    AA                                               2.5M      30
M      14  M
 Au    AA                                               2  B       5
B      -2  B
```

Ba	AA	300	160	150	30	30	200
Co	AA	-5	6	23	39	43	14
Cr	AA	-5	5	217	116	205	72
Cu	AA	6	14	37	92	64	16
Li	AA	4	19	4	8	14	24
Ni	AA	-5	5	54	46	102	27
Pb	AA	40	51	26	74	31	28
Sb	AA				0.2M	1M	1.3M
Zn	AA	34	70	158	109	90	70
B	ICP/OES				-5	15	115
Be	ICP/OES	1	1	1	2	1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	4	9	25	45	40	12
Sr	ICP/OES	60	95	85	150	290	155
V	ICP/OES	3	25	245	395	265	85
Y	ICP/OES	8	6	2	24	18	7
Ga	XRF				18	21	20
Nb	XRF	5	-1	7	40	30	15
Rb	XRF	50	10	20	7	6	21
Zr	XRF	40	170	2	30	35	130
Sn	XRF				3	3	2
Ce	ICP-MS				60	55	75
La	ICP-MS				70	60	40
Nd	ICP-MS				100	95	65

```
 MAJOR OXIDE LISTING

                 82RPS-0093 82RPS-0094 82RPS-0095 82RPS-0096
82RPS-0097 82RPS-0098

 SiO2                 62.70      64.30      70.70      74.70      40.30
     65.50
 Al2O3                10.70      19.30      15.20      15.50      12.40
     14.40
 Fe2O3                 1.07       5.56       3.90       1.26       3.53
      1.41
 FeO                   5.92       4.67       3.43       3.43       8.62
      4.38
 MgO                   2.35       0.36       1.32       0.71       5.82
      1.96
 CaO                   5.78       0.61       1.43       0.60       9.19
      3.45
 Na2O                  0.34       0.40      00.00       0.42      00.00
      0.30
 K2O                   0.46       0.35       0.01       0.40       0.52
      0.86
 TiO2                  0.42       0.70       0.54       0.65       1.03
      0.34
 P2O5                  0.06       0.04       0.05       0.07       0.03
      0.04
 MnO                   0.17       0.08       0.16       0.05       0.19
      0.14
 CO2                   8.66       0.46       0.80       0.11      14.60
      4.96
 S                     0.10       0.01       0.09       0.01       0.08
      0.26
 H2O+                  1.30       2.38       2.19       2.01       2.36
      1.93
 H2O-                  0.01       0.02       0.01       0.04       0.04
      0.05
 LOI                   9.00       3.00       2.50       1.90      15.20
      6.40
 TOTAL               100.04      99.24      99.83      99.96      98.71
     99.98
 S.G.                  2.85       2.89       2.87       2.80       2.97
      2.83


 TRACE ELEMENT LISTING

      METHOD  82RPS-0093 82RPS-0094 82RPS-0095 82RPS-0096
82RPS-0097 82RPS-0098

 Ba     AA           110         90         30         90        110
      110
 Co     AA            10         -5          5         -5         36
       11
 Cr     AA            24         35         27         30        159
       10
```

Cu	AA	65	8	24	-5	72	56
Li	AA	18	22	31	26	16	13
Ni	AA	20	24	9	12	69	7
Pb	AA	410	12	40	83	230	500
Zn	AA	88	280	140	98	200	280
Be	ICP/OES	3	1	-1	-1	-1	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	9	17	10	11	30	3
Sr	ICP/OES	115	135	30	130	70	75
V	ICP/OES	55	65	55	70	235	35
Y	ICP/OES	6	10	8	3	6	-2
Nb	XRF	7	7	7	8	15	2
Zr	XRF	95	135	140	80	12	110
Ce	ICP-MS	75	75	75	75	75	75
La	ICP-MS	40	40	40	40	40	40
Nd	ICP-MS	65	65	65	65	65	65

MAJOR OXIDE LISTING

	82RPS-0099	82RPS-0100	82RPS-0101	82RPS-0102	82RPS-0103	82RPS-0104
SiO2	40.90	52.80	71.90	77.30	64.60	69.50
Al2O3	12.10	13.50	12.60	13.60	16.00	15.40
Fe2O3	1.70	2.53	0.51	0.41	1.87	2.85
FeO	9.42	7.67	2.34	1.02	5.19	5.04
MgO	5.47	1.73	1.16	0.50	1.77	1.68
CaO	9.86	6.76	2.48	0.52	2.77	1.62
Na2O	0.44	1.57	3.91	3.10	0.05	00.00
K2O	0.42	1.01	0.88	1.65	0.90	0.01
TiO2	0.82	0.41	0.42	0.09	0.55	0.54
P2O5	0.02	0.03	0.04	0.01	0.05	0.05
MnO	0.16	0.17	0.04	0.03	0.08	0.17
CO2	15.60	10.00	1.96	0.21	3.80	1.38
S	0.01	0.01	0.01	0.01	0.04	0.04
H2O+	2.26	1.88	1.34	1.19	2.24	2.28
H2O-	0.04	0.02	0.04	0.02	0.04	0.03
LOI	16.40	10.10	2.90	1.00	5.10	2.80
TOTAL	98.22	100.09	99.63	99.66	99.95	100.59
S.G.	2.94	2.89	2.69	2.68	2.87	2.89

TRACE ELEMENT LISTING

	METHOD	82RPS-0099	82RPS-0100	82RPS-0101	82RPS-0102	82RPS-0103	82RPS-0104
Ba	AA	70	140	140	290	240	30
Co	AA	36	30	-5	-5	-5	7
Cr	AA	202	37	-5	-5	33	28

Cu	AA	77	25	-5	-5	33	30
Li	AA	19	10	15	12	8	23
Ni	AA	62	50	-5	-5	-5	14
Pb	AA	260	59	96	320	430	110
Zn	AA	89	155	59	50	47	150
Be	ICP/OES	-1	-1	3	1	1	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	30	19	-1	-1	6	4
Sr	ICP/OES	120	150	70	80	115	30
V	ICP/OES	215	110	4	1	60	50
Y	ICP/OES	-2	4	45	5	6	8
Nb	XRF	11	7	9	5	7	7
Zr	XRF	4	90	235	50	135	135
Ce	ICP-MS	75	75	75	75	75	75
La	ICP-MS	40	40	40	40	40	40
Nd	ICP-MS	65	65	65	65	65	65

MAJOR OXIDE LISTING

	82RPS-0105	82RPS-0106	82RPS-0107	82RPS-0108	83RPS-0224
SiO2	53.30	55.00	64.90	63.80	67.20
Al2O3	13.50	12.60	16.00	16.00	15.00
Fe2O3	2.15	4.57	0.77	1.62	3.45
FeO	9.64	7.60	2.34	4.45	3.42
MgO	1.27	0.97	0.69	0.62	0.35
CaO	6.31	6.55	3.05	2.61	2.14
Na2O	2.17	1.58	5.40	1.47	4.56
K2O	0.51	0.35	0.85	2.28	0.64
TiO2	0.44	0.45	0.47	0.50	0.59
P2O5	0.04	0.03	00.00	0.04	0.01
MnO	0.28	0.23	0.10	0.07	0.12
CO2	9.00	8.55	4.42	4.27	1.85
S	0.08	0.03	0.01	0.02	0.04
H2O+	1.65	1.66	0.84	1.84	0.70
H2O-	0.05	0.06	0.08	0.06	0.07
LOI	9.30	9.00	5.00	5.50	2.20
TOTAL	100.39	100.23	99.92	99.65	100.10
S.G.	2.90	2.89	2.77	2.81	2.77

TRACE ELEMENT LISTING

	METHOD	82RPS-0105	82RPS-0106	82RPS-0107	82RPS-0108	83RPS-0224	
Ag	AA					-2	
As	AA					-1	M
Au	AA					-2	B

Ba	AA	130	120	180	230	170
Co	AA	17	18	5	16	9
Cr	AA	13	13	33	72	35
Cu	AA	20	48	12	18	16
Li	AA	6	6	10	7	12
Ni	AA	31	27	13	50	32
Pb	AA	720	215	178	186	147
Sb 0.5M	AA					
Zn	AA	140	160	65	86	50
B	ICP/OES					33
Be	ICP/OES	-1	-1	1	-1	1
Mo	ICP/OES	-10	-10	-10	-10	-10
Sc	ICP/OES	12	8	3	9	10
Sr	ICP/OES	95	125	150	205	210
V	ICP/OES	75	75	65	85	65
Y	ICP/OES	4	3	3	3	10
Ga	XRF					13
Nb	XRF	7	7	6	5	12
Rb	XRF					19
Zr	XRF	80	70	110	95	95
Sn	XRF					2
Ce	ICP-MS	75	75	75	75	60
La	ICP-MS	40	40	40	40	40
Nd	ICP-MS	65	65	65	65	50

MAJOR OXIDE STATISTICS

TOTAL NUMBER OF SAMPLES: 29

	MEAN	STD. DEVIATION
SiO2	62.05	10.72
Al2O3	14.81	2.24
Fe2O3	2.11	1.49
FeO	5.39	2.51
MgO	1.99	1.95
CaO	4.03	3.53
Na2O	1.28	1.53
K2O	0.72	0.60
TiO2	0.62	0.31
P2O5	0.05	0.04
MnO	0.14	0.06
CO2	4.51	4.93
S	0.06	0.09
H2O+	1.97	0.62
H2O-	0.06	0.04
LOI	5.78	4.57
TOTAL	99.75	0.57
S.G.	2.85	0.07

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	4	-2.00	0.00
As	4	11.37	13.97
Au	4	0.75	3.40
Ba	29	147.24	76.81
Co	29	12.00	14.04
Cr	29	50.07	65.69
Cu	29	28.52	25.84
Li	29	13.31	7.21
Ni	29	23.76	27.37
Pb	29	155.83	172.96
Sb	4	0.75	0.49
Zn	29	117.03	64.84
B	4	39.50	52.67
Be	29	0.55	1.27
Mo	29	-10.00	0.00
Sc	29	12.79	11.20
Sr	29	112.93	57.19
V	29	90.24	92.05
Y	29	7.69	8.84
Ga	4	18.00	3.56
Nb	29	8.69	8.28
Rb	11	15.73	12.51
Zr	29	104.24	61.85
Sn	4	2.50	0.58
Ce	20	72.50	6.18
La	20	42.50	7.86
Nd	20	67.50	10.82

SAGE
CHLORITOID-BEARING INT-MAFIC METAVOLCANICS, AREA II

MAJOR OXIDE LISTING

	82RPS-0127	82RPS-0128	82RPS-0129	82RPS-0130	82RPS-0131	82RPS-0132
SiO2	43.90	48.20	37.70	38.10	49.60	41.90
Al2O3	14.10	15.20	10.70	8.53	13.30	14.50
Fe2O3	1.37	2.82	1.33	1.11	1.53	1.35
FeO	11.00	8.98	15.00	10.70	11.20	11.00
MgO	2.87	4.76	5.25	5.97	2.33	3.98
CaO	8.53	5.57	9.49	12.00	7.18	8.66
Na2O	0.79	0.18	00.00	00.00	0.16	0.51
K2O	0.22	0.62	0.06	0.27	0.14	0.32
TiO2	1.53	1.05	0.68	0.75	0.80	0.94
P2O5	0.06	0.03	0.02	0.02	0.01	0.03
MnO	0.19	0.13	0.27	0.24	0.20	0.17
CO2	12.70	8.30	15.00	18.30	10.92	13.50
S	0.15	0.01	0.50	0.10	0.11	0.04
H2O+	2.19	2.82	2.81	1.84	2.00	2.45
H2O-	0.06	0.08	0.09	0.07	0.10	0.10
LOI	13.00	10.50	15.40	18.70	11.30	14.40
TOTAL	99.66	98.75	98.90	98.00	99.58	99.45
S.G.	2.98	2.90	3.00	2.94	2.98	2.97

TRACE ELEMENT LISTING

	METHOD	82RPS-0127	82RPS-0128	82RPS-0129	82RPS-0130	82RPS-0131	82RPS-0132
Ba	AA	80	90	40	110	50	120
Co	AA	54	41	53	35	30	24
Cr	AA	125	254	77	32	140	157
Cu	AA	40	38	142	118	130	88
Li	AA	7	16	11	12	4	11
Ni	AA	56	76	85	26	56	53
Pb	AA	480	185	300	106	136	-10
Zn	AA	76	140	180	95	86	87
Be	ICP/OES	1	1	1	-1	-1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	35	40	40	30	19	45
Sr	ICP/OES	55	45	30	65	45	90
V	ICP/OES	320	300	270	215	200	315
Y	ICP/OES	6	-2	-2	2	-2	-2
Nb	XRF	18	17	17	15	12	16
Zr	XRF	7	8	6	9	8	7

MAJOR OXIDE LISTING

	82RPS-0133	82RPS-0134	82RPS-0135	82RPS-0136	82RPS-0137	82RPS-0138
SiO2	37.70	40.20	40.40	44.40	46.20	42.00
Al2O3	10.90	12.00	12.30	14.30	13.00	12.00
Fe2O3	1.30	2.57	2.67	3.74	4.15	1.52
FeO	10.20	8.11	9.57	9.86	8.25	9.93
MgO	5.67	5.33	5.54	5.55	5.21	3.97
CaO	12.00	1.08	9.49	6.59	10.40	10.50
Na2O	0.12	0.12	00.00	00.00	2.11	0.24
K2O	0.11	0.51	0.25	0.17	00.00	0.56
TiO2	0.63	0.74	0.83	1.54	1.18	0.81
P2O5	0.01	0.01	0.03	0.05	0.04	0.02
MnO	0.21	0.19	0.19	0.21	0.18	0.18
CO2	18.00	15.90	14.40	10.00	4.87	15.30
S	0.10	0.05	0.08	1.20	0.14	0.01
H2O+	1.78	1.91	2.32	2.85	3.10	1.99
H2O-	0.11	0.09	0.08	0.08	0.10	0.06
LOI	18.30	17.30	15.60	10.70	7.00	15.80
TOTAL	98.84	88.81	98.15	100.54	98.93	99.09
S.G.	2.97	2.96	2.98	3.00	2.89	2.94

TRACE ELEMENT LISTING

	METHOD	82RPS-0133	82RPS-0134	82RPS-0135	82RPS-0136	82RPS-0137	82RPS-0138
Ba	AA	90	330	80	60	30	120
Co	AA	29	33	26	37	40	34
Cr	AA	57	73	65	68	75	124
Cu	AA	44	36	153	120	83	49
Li	AA	4	4	14	28	6	6
Ni	AA	39	49	97	36	49	56
Pb	AA	510	50	86	158	181	52
Zn	AA	84	88	100	230	135	86
Be	ICP/OES	1	-1	1	1	1	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	30	35	25	40	30	30
Sr	ICP/OES	115	95	100	35	115	45
V	ICP/OES	200	215	200	320	335	225
Y	ICP/OES	2	2	3	-2	15	-2
Nb	XRF	14	15	14	18	21	15
Zr	XRF	6	11	30	5	16	1

MAJOR OXIDE LISTING

	82RPS-0139	81RPS-0171	81RPS-0172	81RPS-0173	81RPS-0182	81RPS-0183
SiO2	52.00	41.80	41.60	67.80	43.10	40.80
Al2O3	15.20	12.60	12.10	17.50	13.70	13.10
Fe2O3	2.95	1.70	5.88	0.76	2.00	2.20
FeO	9.71	9.86	6.05	1.90	9.42	9.42
MgO	1.69	5.44	5.55	0.90	5.64	4.59
CaO	5.86	9.31	9.44	2.32	8.61	10.20
Na2O	0.30	0.47	0.38	1.40	0.30	0.29
K2O	0.22	0.30	0.41	1.12	0.14	0.44
TiO2	0.51	1.04	1.04	0.84	0.77	0.89
P2O5	0.04	0.06	0.06	0.16	0.04	0.04
MnO	0.50	0.22	0.22	0.04	0.15	0.20
CO2	8.92	13.80	14.20	2.88	12.80	15.20
S	0.03	0.03	0.08	0.03	0.23	0.03
H2O+	2.28	2.36	2.36	2.29	2.70	2.23
H2O-	0.07	0.18	0.13	0.11	0.13	0.10
LOI	9.50	15.40	15.70	4.50	13.80	15.90
TOTAL	100.28	99.17	99.50	100.05	99.73	99.73
S.G.	2.98	2.96	2.97	2.74	2.97	2.97

TRACE ELEMENT LISTING

	METHOD	82RPS-0139	81RPS-0171	81RPS-0172	81RPS-0173	81RPS-0182	81RPS-0183
Ba	AA	70	90	120	210	190	170
Co	AA	13	18	19	6	32	17
Cr	AA	15	80	80	47	238	172
Cu	AA	12	94	44	38	66	138
Li	AA	8	16	14	20	20	-3
Ni	AA	17	59	68	15	56	44
Pb	AA	250	12	11	21	17	-10
Zn	AA	130	190	200	36	195	210
Be	ICP/OES	-1	1	1	1	1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	12	24	22	9	23	25
Sr	ICP/OES	105	105	90	320	45	55
V	ICP/OES	80	260	270	90	240	240
Y	ICP/OES	5	2	2	2	2	4
Nb	XRF	9	9	9	5	8	6
Rb	XRF		10	10	30	-10	20
Zr	XRF	75	11	9	175	4	13

MAJOR OXIDE LISTING

	82RPS-0171	82RPS-0172	82RPS-0173	82RPS-0174	82RPS-0175	83RPS-0214
SiO2	50.50	43.80	48.60	47.00	52.30	48.00
Al2O3	14.60	16.20	15.20	18.00	16.90	13.40
Fe2O3	0.51	1.60	0.97	0.93	0.98	4.71
FeO	8.69	10.40	8.76	6.72	8.03	9.24
MgO	5.14	2.90	5.13	3.00	3.09	6.26
CaO	6.54	7.10	6.36	6.90	5.23	5.21
Na2O	00.00	0.64	0.03	0.60	0.07	2.22
K2O	0.23	1.38	0.46	2.01	1.24	00.00
TiO2	1.19	1.30	1.50	1.00	1.08	1.37
P2O5	0.06	0.05	0.07	0.04	0.01	00.00
MnO	0.24	0.55	0.25	0.24	0.20	0.15
CO2	8.92	10.80	9.28	11.00	8.20	3.44
S	0.03	0.46	0.19	0.06	0.02	0.01
H2O+	2.81	2.85	2.96	2.15	2.29	4.80
H2O-	0.06	0.04	0.05	0.07	0.06	0.10
LOI	10.60	11.70	11.00	11.80	9.60	7.50
TOTAL	99.52	100.07	99.81	99.72	99.70	98.90
S.G.	2.90	2.92	2.91	2.89	2.91	2.83

TRACE ELEMENT LISTING

	METHOD	82RPS-0171	82RPS-0172	82RPS-0173	82RPS-0174	82RPS-0175	83RPS-0214
Ag	AA						-2
As	AA						2 M
Au	AA						-2 B
Ba	AA	70	180	80	310	280	30
Co	AA	28	51	40	30	41	40
Cr	AA	185	204	71	402	330	83
Cu	AA	162	90	181	116	106	96
Li	AA	60	28	42	14	20	80
Ni	AA	95	90	74	91	118	72
Pb	AA	600	160	425	345	470	87
Sb	AA						0.2M
Zn	AA	170	160	190	66	97	145
B	ICP/OES						13
Be	ICP/OES	1	2	1	1	1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	30	40	35	30	40	35
Sr	ICP/OES	30	60	30	50	30	60
V	ICP/OES	220	295	300	290	325	265
Y	ICP/OES	3	3	4	-2	-2	17
Cs	XRF	-10	-10	-10	-10	-10	
Ga	XRF						20
Nb	XRF	16	18	19	17	17	30
Rb	XRF	-10	20	-10	40	20	6
Zr	XRF	45	18	70	2	5	40
Ta	XRF	-30	-30	-30	-30	-30	
Sn	XRF						3

Th	ICP-MS	-10	-10	-10	-10	-10	
Ce	ICP-MS	35	40	45	-35	-35	60
La	ICP-MS						75
Nd	ICP-MS	65	65	65	55	40	80

MAJOR OXIDE LISTING

	83RPS-0215	83RPS-0216	83RPS-0217	83RPS-0218	83RPS-0219	81RPS-0158
SiO2	46.50	63.00	65.50	49.80	50.40	36.30
Al2O3	13.80	18.30	16.80	15.00	12.60	9.20
Fe2O3	0.65	2.83	0.68	4.86	2.61	1.90
FeO	10.40	3.85	4.29	8.15	11.40	12.00
MgO	5.13	0.55	0.69	4.74	5.91	5.76
CaO	6.86	1.47	2.23	8.59	8.22	12.50
Na2O	0.91	2.63	2.10	1.94	2.96	0.47
K2O	0.17	0.69	0.67	0.03	0.21	0.10
TiO2	1.54	0.73	0.68	1.67	1.60	0.52
P2O5	0.04	0.09	0.08	0.01	0.04	0.08
MnO	0.20	0.17	0.21	0.18	0.21	0.44
CO2	10.90	1.60	2.86	0.88	0.47	18.10
S	0.01	0.01	0.10	0.14	0.15	0.18
H2O+	3.35	2.26	1.90	3.16	2.43	2.15
H2O-	0.07	0.08	0.05	0.05	0.03	0.08
LOI	12.50	3.50	4.60	3.80	2.40	19.30
TOTAL	100.50	98.30	98.80	99.20	99.20	99.78
S.G.	2.91	2.89	2.88	2.81	2.88	2.96

TRACE ELEMENT LISTING

	METHOD	83RPS-0215	83RPS-0216	83RPS-0217	83RPS-0218	83RPS-0219	81RPS-0158
Ag	AA	-2	-2	-2	-2	-2	
As	AA	10 M	24 M	6.5M	2.5M	8 M	
Au	AA	-2 B	-2 B	-2 B	-2 B	-2 B	
Ba	AA	70	200	150	30	50	50
Co	AA	34	18	6	37	40	21
Cr	AA	83	81	71	114	58	144
Cu	AA	48	8	5	58	56	87
Li	AA	78	42	36	16	6	18
Ni	AA	46	28	7	47	36	81
Pb	AA	29	53	36	48	-10	13
Sb	AA	0.8M	4.4M	2.5M	0.4M	1 M	
Zn	AA	180	144	68	116	104	156
B	ICP/OES	86	30	44	7	-5	
Be	ICP/OES	1	2	2	1	2	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	45	12	15	40	55	25
Sr	ICP/OES	80	215	315	145	105	45
V	ICP/OES	285	95	90	320	355	170
Y	ICP/OES	6	8	8	30	30	4
Ga	XRF	21	21	16	23	24	
Nb	XRF	30	16	15	35	35	5
Rb	XRF	10	21	21	5	11	-10
Zr	XRF	65	140	120	40	45	5
Sn	XRF	8	3	3	4	3	
Ce	ICP-MS	60	80	75	65	65	65
La	ICP-MS	60	50	40	70	80	80

Nd	ICP-MS	85	50	55	95	100	100

MAJOR OXIDE LISTING

	81RPS-0159
SiO2	40.70
Al2O3	11.60
Fe2O3	5.31
FeO	7.10
MgO	3.95
CaO	11.40
Na2O	0.65
K2O	0.16
TiO2	0.69
P2O5	0.10
MnO	0.36
CO2	16.30
S	0.10
H2O+	1.88
H2O-	0.10
LOI	17.10
TOTAL	100.40
S.G.	2.97

TRACE ELEMENT LISTING

	METHOD	81RPS-0159
Ba	AA	80
Co	AA	54
Cr	AA	221
Cu	AA	66
Li	AA	8
Ni	AA	120
Pb	AA	-10
Zn	AA	118
Be	ICP/OES	1
Mo	ICP/OES	-10
Sc	ICP/OES	35
Sr	ICP/OES	60
V	ICP/OES	250
Y	ICP/OES	4
Nb	XRF	9
Rb	XRF	-10
Zr	XRF	19
Ce	ICP-MS	65
La	ICP-MS	80
Nd	ICP-MS	100

MAJOR OXIDE STATISTICS

TOTAL NUMBER OF SAMPLES: 31

	MEAN	STD. DEVIATION
SiO2	46.45	7.75
Al2O3	13.76	2.40
Fe2O3	2.24	1.47
FeO	9.01	2.55
MgO	4.27	1.67
CaO	7.61	3.05
Na2O	0.73	0.87
K2O	0.43	0.46
TiO2	1.01	0.34
P2O5	0.05	0.03
MnO	0.23	0.10
CO2	10.57	5.32
S	0.14	0.23
H2O+	2.49	0.60
H2O-	0.08	0.03
LOI	11.88	4.79
TOTAL	99.07	2.01
S.G.	2.93	0.06

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	6	-2.00	0.00
As	6	8.83	8.05
Au	6	-2.00	0.00
Ba	31	117.10	81.17
Co	31	31.65	12.92
Cr	31	126.65	88.83
Cu	31	81.03	46.96
Li	31	20.84	20.51
Ni	31	59.42	28.62
Pb	31	154.23	179.11
Sb	6	1.55	1.61
Zn	31	131.03	49.98
B	6	29.17	32.77
Be	31	0.81	0.87
Mo	31	-10.00	0.00
Sc	31	30.68	10.72
Sr	31	89.68	72.86
V	31	243.71	76.32
Y	31	4.77	8.13
Cs	5	-10.00	0.00
Ga	6	20.83	2.79
Nb	31	16.13	7.73
Rb	18	9.67	15.11
Zr	31	32.74	43.28
Ta	5	-30.00	0.00
Sn	6	4.00	2.00
Th	5	-10.00	0.00
Ce	13	45.00	37.75
La	8	66.87	15.34
Nd	13	73.46	21.05

SAGE
ALTERED BRECCIAS-MAGPIE MINE AREA, AREA II

MAJOR OXIDE LISTING

	83RPS-0196	83RPS-0197	83RPS-0198	83RPS-0199	84RPS-0048	84RPS-0083
SiO_2	64.80	71.20	63.30	74.10	68.70	66.20
Al_2O_3	16.40	15.50	15.10	14.60	17.30	17.90
Fe_2O_3	1.26	0.45	1.20	0.17	1.13	0.46
FeO	1.96	1.02	2.25	0.73	0.68	1.20
MgO	1.99	0.34	1.31	0.24	0.46	0.38
CaO	2.89	4.23	5.30	1.84	4.12	3.32
Na_2O	4.25	1.05	1.54	5.31	2.31	3.63
K_2O	1.72	1.42	2.97	1.01	2.23	2.10
TiO_2	0.67	0.50	0.50	0.35	0.45	0.51
P_2O_5	0.05	0.06	0.04	0.09	0.01	0.08
MnO	0.09	0.03	0.05	0.02	0.05	0.05
CO_2	0.78	1.12	3.22	0.90	0.38	1.82
S	0.34	0.01	00.00	0.01	0.01	0.01
H_2O+	1.42	1.66	1.98	0.37	1.23	1.79
H_2O-	0.05	0.05	0.07	0.02	0.02	0.06
LOI	2.80	3.00	5.40	1.90	1.80	3.30
TOTAL	98.70	98.60	98.80	99.80	99.10	99.50
S.G.	2.74	2.79	2.76	2.68	2.71	2.73

TRACE ELEMENT LISTING

	METHOD	83RPS-0196		83RPS-0197		83RPS-0198		83RPS-0199		84RPS-0048		84RPS-0083	
Ag	AA	-2		-2		-2		-2		-2		-2	
As	AA	850		250		100		300		200		150	
Au	AA	-206	9	-202	3	203	1	-202	1	303	8	-203	1
Bi	AA	16		-5		16		-5		-5		6	
Co	AA	1050	1	50		50		-50		-100		-100	
Cr	AA	300		1800		1000		1200		2000		2200	
Cu	AA	2	1	2	8	2	1			1	0	1	2
Li	AA	25		-5		7		-5		-5		-5	
Ni	AA	200		170		-100		-100		130		-100	
Sb	AA	4000		2000		4000		3000		4000		2000	
Zn	AA	142		46		86		51		52		50	
Be	ICP/OES	160		-50		620		340		330		490	
Co	ICP/OES	100	1	100	1	100	1	100	1	100	1	100	1
Cu	ICP/OES	5	0	5	0	5	0	1	0	7	0	6	0
Mo	ICP/OES	9		12		12		6					
Ni	ICP/OES	80		90		90		40	-	70		70	
Sc	ICP/OES	204	0	202	0	202	0	103	0	3	9	3	2
Sr	ICP/OES	5	0	5005	0	5005	0	5001	0	4	5	4	0
V	ICP/OES	11		13		11		13		8		7	
W	ICP/OES	1100		850		1200		950					
Zn	ICP/OES			5000		5000				9000			
		30		23		25		21		-35		-35	
Sr	XRF	45		40		71		45		50		38	
Ta	XRF									15	0		

Cd AA 2200 2100

MAJOR OXIDE LISTING

```
             84RPS-0084 84RPS-0085 84RPS-0086 84RPS-0087 84RPS-0088 84RPS-0089

SiO2             69.20      68.30      68.20      67.00      65.30      61.30
Al2O3            16.20      16.30      16.80      14.40      14.90      19.90
Fe2O3             1.47       1.05       0.82       0.55       1.11       1.59
FeO               1.03       0.94       0.60       1.20       1.46       3.17
MgO               0.59       0.46       0.23       0.53       0.54       0.68
CaO               4.17       3.95       2.23       5.77       5.68       3.13
Na2O              1.41       3.59       4.31       3.21       1.84       3.30
K2O               1.90       1.80       2.59       1.67       2.62       2.39
TiO2              0.42       0.44       0.48       0.32       0.52       0.61
P2O5              0.06       0.05       0.06       0.05       0.09       0.03
MnO               0.07       0.03       0.03       0.06       0.12       0.08
CO2               0.29       1.25       1.39       3.62       2.83       0.98
S                 0.01       0.01       0.02       0.01       0.01       0.01
H2O+              1.69       1.10       1.28       1.32       1.40       2.30
H2O-             00.00      00.00      00.00      00.00      00.00      00.00
LOI               1.90       2.30       1.80       5.00       4.30       2.90
TOTAL            98.50      99.30      99.00      99.70      98.40      99.50
S.G.              2.83       2.78       2.69       2.69       2.76       2.75
```

TRACE ELEMENT LISTING

```
     METHOD  84RPS-0084 84RPS-0085 84RPS-0086 84RPS-0087 84RPS-0088 84RPS-0089

Ag    AA          -2         -2         -2         -2         -2         -2
As    AA         150        100        150        100        100        100
Au    AA        -203  8     302  9    -203  8    -203  5    -204  4    -203  6
Bi    AA          -5         -5          6         -5         10          7
Co    AA        -100       -100       -100       -100        130       -100
Cr    AA        1400       1200       1700        600       3400       3500
Cu    AA           1  4                             1  6                  1  8
Li    AA          -5         -5         -5         -5         10         -5
Ni    AA         130       -100       -100       -100       -100       -100
Sb    AA        5000       4000       4000       3000       3000       2000
Zn    AA          72         58         45        114         42         80
Be    ICP/OES    240        210        220       1000        240        390
Co    ICP/OES    100  1     100  1     100  2     100  1     100  1     100  2
Cu    ICP/OES      6  0       8  0                  3  0       6  0       3  0
Ni    ICP/OES     90         70         60         50         90         80
Sc    ICP/OES      3  5       2  3       1  1       2  9       3  6       2  9
Sr    ICP/OES      4  0    5004  5    5004  5       2  0    5004  5    5007  0
V     ICP/OES     10          9          8         11         12          9
Zn    ICP/OES   5000                             6000       5000       5000
                 -35        -35        -35        -35        -35        -35
Sr    XRF         42         43         65         55         65         43
Cd    AA        4000       3400       2900       2000       3100       2100
```

MAJOR OXIDE LISTING

	84RPS-0090	84RPS-0082
SiO2	67.80	69.30
Al2O3	16.80	17.00
Fe2O3	1.21	0.49
FeO	0.43	1.03
MgO	0.32	0.35
CaO	5.85	4.03
Na2O	1.33	0.98
K2O	1.74	2.12
TiO2	0.44	0.51
P2O5	0.15	0.11
MnO	0.03	0.04
CO2	1.16	1.31
S	0.02	0.01
H2O+	1.73	1.91
H2O-	00.00	00.00
LOI	2.70	3.50
TOTAL	99.00	99.20
S.G.	2.81	2.80

TRACE ELEMENT LISTING

	METHOD	84RPS-0090		84RPS-0082	
Ag	AA	-2		-2	
As	AA	150		350	
Au	AA	403	8	303	9
Bi	AA	-5		5	
Co	AA	-100		-100	
Cr	AA	3100		2500	
Cu	AA	1	4	2	6
Li	AA	-5		-5	
Ni	AA	-100		-100	
Sb	AA	5000		4000	
Zn	AA	50		72	
Be	ICP/OES	290		720	
Co	ICP/OES	100	1	100	1
Cu	ICP/OES	8	0	5	0
Ni	ICP/OES	70		70	
Sc	ICP/OES	4	5	3	1
Sr	ICP/OES	4	5	4	0
V	ICP/OES	12		11	
Zn	ICP/OES	6000			
		-35		-35	
Sr	XRF	43		44	
Cd	AA	4600		3600	

MAJOR OXIDE STATISTICS

TOTAL NUMBER OF SAMPLES: 14

	MEAN	STD. DEVIATION
SiO2	67.48	3.24
Al2O3	16.36	1.47
Fe2O3	0.93	0.43
FeO	1.26	0.74
MgO	0.60	0.48
CaO	4.04	1.28
Na2O	2.72	1.40
K2O	2.02	0.52
TiO2	0.48	0.09
P2O5	0.07	0.04
MnO	0.05	0.03
CO2	1.50	1.02
S	0.03	0.09
H2O+	1.51	0.47
H2O-	0.02	0.03
LOI	3.04	1.17
TOTAL	99.08	0.45
S.G.	2.75	0.05

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	14	-2.00	0.00
As	14	217.86	198.66
Au	14	-22.50	254.66
Bi	14	2.21	8.15
Co	14	23.57	304.97
Cr	14	1850.00	1000.58
Cu	10	1.40	0.52
Li	14	-0.93	8.93
Ni	14	-26.43	121.82
Sb	14	3500.00	1019.05
Zn	14	68.57	29.18
Be	14	371.43	264.28
Co	14	100.00	0.00
Cu	13	5.23	2.01
Mo	4	9.75	2.87
Ni	14	72.86	15.41
Sc	14	52.64	85.53
Sr	14	2504.07	2594.60
V	14	10.36	1.91
W	4	1025.00	155.46
Zn	8	5750.00	1388.73
	14	-17.93	28.07
Sr	14	49.21	10.56
Ta	1	15.00	0.00
Cd	10	3000.00	904.31

SAGE
CHLORITOID-BEARING INT-MAFIC INTRUSIVE RKS., AREA II

MAJOR OXIDE LISTING

	82RPS-0113	82RPS-0114	83RPS-0223
SiO2	42.40	39.30	45.00
Al2O3	12.20	10.90	13.10
Fe2O3	3.07	7.00	00.00
FeO	13.40	9.42	11.50
MgO	2.68	3.47	3.10
CaO	7.77	9.01	8.95
Na2O	0.20	0.42	0.83
K2O	0.15	0.24	0.25
TiO2	1.62	2.19	1.30
P2O5	0.11	0.04	0.03
MnO	0.27	0.21	0.22
CO2	13.20	15.10	13.90
S	0.03	0.01	0.10
H2O+	1.93	2.03	1.60
H2O-	0.07	0.07	0.07
LOI	13.20	15.00	13.70
TOTAL	99.10	99.41	99.90
S.G.	3.06	3.02	2.99

TRACE ELEMENT LISTING

	METHOD	82RPS-0113	82RPS-0114	83RPS-0223
Ag	AA			-2
As	AA			38 M
Au	AA			-2 B
Ba	AA	70	80	170
Co	AA	26	39	31
Cr	AA	-5	12	73
Cu	AA	60	127	102
Li	AA	16	18	22
Ni	AA	5	23	32
Pb	AA	29	45	24
Sb	AA			2.2M
Zn	AA	180	170	128
B	ICP/OES			8
Be	ICP/OES	-1	1	2
Mo	ICP/OES	-10	-10	-10
Sc	ICP/OES	25	40	50
Sr	ICP/OES	95	115	100
V	ICP/OES	165	420	300
Y	ICP/OES	7	2	9
Ga	XRF			18
Nb	XRF	11	20	30
Rb	XRF			11
Zr	XRF	45	16	55
Sn	XRF			3

Ce	ICP-MS	65
La	ICP-MS	65
Nd	ICP-MS	95

MAJOR OXIDE STATISTICS

TOTAL NUMBER OF SAMPLES: 3

	MEAN	STD. DEVIATION
SiO2	42.23	2.85
Al2O3	12.07	1.11
Fe2O3	3.36	3.51
FeO	11.44	1.99
MgO	3.08	0.40
CaO	8.58	0.70
Na2O	0.48	0.32
K2O	0.21	0.06
TiO2	1.70	0.45
P2O5	0.06	0.04
MnO	0.23	0.03
CO2	14.07	0.96
S	0.05	0.05
H2O+	1.85	0.23
H2O-	0.07	0.00
LOI	13.97	0.93
TOTAL	99.47	0.40
S.G.	3.02	0.04

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	1	-2.00	0.00
As	1	38.00	0.00
Au	1	-2.00	0.00
Ba	3	106.67	55.08
Co	3	32.00	6.56
Cr	3	26.67	41.02
Cu	3	96.33	33.86
Li	3	18.67	3.06
Ni	3	20.00	13.75
Pb	3	32.67	10.97
Sb	1	2.20	0.00
Zn	3	159.33	27.59
B	1	8.00	0.00
Be	3	0.67	1.53
Mo	3	-10.00	0.00
Sc	3	38.33	12.58
Sr	3	103.33	10.41
V	3	295.00	127.57
Y	3	6.00	3.61
Ga	1	18.00	0.00
Nb	3	20.33	9.50
Rb	1	11.00	0.00
Zr	3	38.67	20.26
Sn	1	3.00	0.00
Ce	1	65.00	0.00
La	1	65.00	0.00
Nd	1	95.00	0.00

SAGE
TOURMALINE-BEARING INT-MAFIC METAVOLCANICS RKS., AREA II

MAJOR OXIDE LISTING

	82RPS-0126	83RPS-0179	83RPS-0180	83RPS-0181	83RPS-0182	83RPS-0183
SiO2	43.70	52.60	45.40	44.60	49.10	47.00
Al2O3	13.20	15.10	16.30	14.60	13.10	14.30
Fe2O3	2.08	1.74	0.87	2.47	3.29	3.19
FeO	7.67	6.84	10.00	9.09	6.84	9.96
MgO	6.50	3.91	5.71	6.32	2.73	5.11
CaO	11.70	8.97	6.91	8.90	11.80	6.95
Na2O	0.75	2.84	4.13	2.54	2.02	2.41
K2O	00.00	00.00	00.00	00.00	00.00	0.02
TiO2	0.64	0.88	0.97	0.86	1.42	1.53
P2O5	0.06	0.01	0.02	0.01	0.04	0.02
MnO	0.18	0.14	0.21	0.21	0.28	0.27
CO2	8.06	3.38	4.29	5.46	5.39	4.14
S	0.01	0.02	00.00	0.01	0.02	0.02
H2O+	3.45	3.12	4.07	4.55	2.89	4.94
H2O-	0.05	0.08	0.07	0.08	0.11	0.12
LOI	10.80	6.40	7.70	9.70	8.10	8.60
TOTAL	98.05	99.60	99.00	99.70	99.00	100.00
S.G.	2.84	2.85	2.81	2.83	2.88	2.84

TRACE ELEMENT LISTING

	METHOD	82RPS-0126	83RPS-0179	83RPS-0180	83RPS-0181	83RPS-0182	83RPS-0183
Ag	AA		-2	-2	-2	-2	-2
As	AA		3 M	7.5M	5.5M	6.5M	9 M
Au	AA	4 B	16 B	2 B	13 B	18 B	80 B
Ba	AA	60	30	20	30	50	150
Co	AA	36	42	36	46	36	36
Cr	AA	259	302	246	298	136	136
Cu	AA	62	96	38	79	84	72
Li	AA	16	6	5	7	4	11
Ni	AA	114	112	93	127	42	44
Pb	AA	12	-10	-10	23	35	12
Sb	AA		0.7M	0.3M	0.2M	0.4M	0.3M
Zn	AA	68	88	73	116	114	165
B	ICP/OES	3700	-5	1000	400	60	130
Be	ICP/OES	-1	1	1	1	2	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	25	40	40	35	45	40
Sr	ICP/OES	35	115	30	35	175	65
V	ICP/OES	150	240	225	230	310	320
Y	ICP/OES	14	14	12	11	30	25
Ga	XRF		12	14	16	23	21
Nb	XRF	14	25	24	25	30	35
Rb	XRF		7	5	6	6	8
Zr	XRF	2	18	15	15	16	23
Sn	XRF		2	2	4	4	3

Ce	ICP-MS	50	45	45	60	60
La	ICP-MS	45	55	60	55	70
Nd	ICP-MS	80	70	80	105	85

MAJOR OXIDE LISTING

	83RPS-0184	83RPS-0185
SiO2	51.70	50.60
Al2O3	14.40	13.40
Fe2O3	3.76	2.44
FeO	7.49	7.42
MgO	3.94	4.02
CaO	8.59	11.00
Na2O	1.96	3.22
K2O	00.00	00.00
TiO2	1.40	1.24
P2O5	0.03	0.03
MnO	0.19	0.18
CO2	2.74	3.42
S	0.01	0.01
H2O+	3.45	2.22
H2O-	0.11	0.10
LOI	6.00	5.50
TOTAL	99.80	99.30
S.G.	2.89	2.91

TRACE ELEMENT LISTING

	METHOD	83RPS-0184	83RPS-0185
Ag	AA	-2	-2
As	AA	17 M	-1 M
Au	AA	60 B	10 B
Ba	AA	40	40
Co	AA	39	40
Cr	AA	182	168
Cu	AA	92	90
Li	AA	4	3
Ni	AA	65	64
Pb	AA	11	14
Sb	AA	0.5M	0.9M
Zn	AA	114	106
B	ICP/OES	700	100
Be	ICP/OES	2	1
Mo	ICP/OES	-10	-10
Sc	ICP/OES	50	45
Sr	ICP/OES	155	195
V	ICP/OES	320	315
Y	ICP/OES	23	22
Ga	XRF	18	15
Nb	XRF	35	30
Rb	XRF	5	6
Zr	XRF	21	17
Sn	XRF	3	2
Ce	ICP-MS	60	55
La	ICP-MS	60	55

Nd	ICP-MS	90	95

```
          MAJOR OXIDE STATISTICS

          TOTAL NUMBER OF SAMPLES:              8


             MEAN   STD. DEVIATION
SiO2        48.09         3.39
Al2O3       14.30         1.08
Fe2O3        2.48         0.93
FeO          8.16         1.32
MgO          4.78         1.34
CaO          9.35         1.96
Na2O         2.48         0.99
K2O          0.00         0.01
TiO2         1.12         0.32
P2O5         0.03         0.02
MnO          0.21         0.05
CO2          4.61         1.69
S            0.01         0.01
H2O+         3.59         0.89
H2O-         0.09         0.02
LOI          7.85         1.84
TOTAL       99.31         0.63
S.G.         2.86         0.03
```

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	7	-2.00	0.00
As	7	6.79	5.57
Au	8	25.37	28.58
Ba	8	52.50	41.32
Co	8	38.87	3.68
Cr	8	215.87	68.79
Cu	8	76.62	19.19
Li	8	7.00	4.41
Ni	8	82.62	33.22
Pb	8	10.87	15.18
Sb	7	0.47	0.25
Zn	8	105.50	30.62
B	8	760.62	1238.79
Be	8	1.00	0.93
Mo	8	-10.00	0.00
Sc	8	40.00	7.56
Sr	8	100.62	68.11
V	8	263.75	62.38
Y	8	18.87	7.02
Ga	7	17.00	3.92
Nb	8	27.25	6.88
Rb	7	6.14	1.07
Zr	8	15.87	6.29
Sn	7	2.86	0.90
Ce	7	53.57	6.90
La	7	57.14	7.56
Nd	7	86.43	11.44

SAGE
FELSIC INTRUSIVES, GUTCHER LK. GRANITIC COMPLEX, AREA II

MAJOR OXIDE LISTING

	86RPS-0053	86RPS-0054	86RPS-0055	86RPS-0056	86RPS-0057	86RPS-0058
SiO2	65.50	66.10	63.70	65.90	65.50	67.70
Al2O3	15.50	15.80	15.90	15.60	15.50	15.10
Fe2O3	1.65	2.26	2.36	1.84	1.86	2.33
FeO	2.52	2.30	2.67	2.59	2.96	2.07
MgO	1.39	1.46	1.66	1.48	1.52	1.16
CaO	4.37	3.57	4.32	3.69	4.04	4.14
Na2O	4.54	4.95	4.41	4.67	4.43	4.93
K2O	0.90	0.59	1.01	0.59	0.56	0.56
TiO2	0.38	0.46	0.43	0.49	0.51	0.36
P2O5	0.09	0.10	0.11	0.10	0.11	0.10
MnO	0.07	0.06	0.06	0.05	0.06	0.07
CO2	1.65	0.51	0.74	0.37	0.45	0.51
S	0.05	0.01	0.01	0.04	0.01	0.01
H2O+	1.10	1.24	1.21	1.09	1.14	0.79
H2O-	0.21	0.15	0.20	0.19	0.28	0.27
LOI	3.00	1.80	2.20	2.00	2.00	1.90
TOTAL	99.90	99.50	98.80	98.70	98.90	100.10
S.G.	2.73	2.73	2.77	2.75	2.77	2.76

TRACE ELEMENT LISTING

	METHOD	86RPS-0053	86RPS-0054	86RPS-0055	86RPS-0056	86RPS-0057	86RPS-0058
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	2.5	2.5	3	3	2.5	5.5
Au	AA	10 B	-2 B	-2 B	95 B	-2 B	-2 B
Co	AA	11	12	14	10	12	10
Cr	AA	17	15	16	19	17	19
Cu	AA	9	6	76	235	30	17
Ni	AA	11	10	11	12	11	11
Pb	AA	-10	-10	-10	-10	18	21
Sb	AA	0.8	1.3	1.8	0.3	0.2	1.4
Zn	AA	52	37	44	28	40	60
B	ICP/OES	8	7	12	6	9	10
Be	ICP/OES	-1	-1	-1	-1	-1	-1
Co	ICP/OES	12	12	15	11	14	12
Cu	ICP/OES	7	3	75	245	30	16
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Ni	ICP/OES	21	19	22	21	21	20
Sc	ICP/OES	10	10	11	11	10	9
Sr	ICP/OES	340	415	505	460	445	500
V	ICP/OES	60	60	75	70	70	65
Y	ICP/OES	9	10	10	9	8	8
Zn	ICP/OES	65	45	55	25	50	75
Ga	XRF	20	19	18	17	19	17
Nb	XRF	-5	-5	-5	-5	-5	-5
Rb	XRF	12	6	12	8	6	6

Sn	AA	5.6	9.5	16.2	3.5	4.1	2.6
Ce	ICP-MS	-35	-35	-35	-35	-35	-35
La	ICP-MS	-35	-35	-35	-35	-35	-35

MAJOR OXIDE LISTING

	86RPS-0059	86RPS-0060	86RPS-0061	86RPS-0062	86RPS-0063	86RPS-0064
SiO2	65.40	66.40	65.10	65.80	67.80	67.20
Al2O3	16.00	16.20	15.70	15.30	15.50	15.80
Fe2O3	2.00	1.24	2.20	1.25	1.44	1.17
FeO	2.96	2.30	2.30	3.11	2.59	1.85
MgO	1.55	1.47	1.31	1.36	1.28	1.40
CaO	2.56	2.63	3.56	3.44	3.93	3.89
Na2O	4.67	5.82	5.61	4.27	4.61	5.67
K2O	1.17	0.58	0.27	1.38	0.38	0.12
TiO2	0.43	0.32	0.50	0.47	0.41	0.43
P2O5	0.10	0.08	0.06	0.11	0.09	0.10
MnO	0.05	0.04	0.05	0.05	0.04	0.04
CO2	0.83	0.75	0.91	2.11	0.21	0.79
S	0.01	0.01	0.01	0.01	0.01	0.01
H2O+	1.30	1.04	0.86	1.01	1.07	0.65
H2O-	0.20	0.07	0.31	0.18	0.07	0.19
LOI	2.40	2.30	2.20	3.60	1.70	1.80
TOTAL	99.20	99.00	98.80	99.80	99.40	99.20
S.G.	2.73	2.71	2.73	2.72	2.74	2.71

TRACE ELEMENT LISTING

	METHOD	86RPS-0059	86RPS-0060	86RPS-0061	86RPS-0062	86RPS-0063	86RPS-0064
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	1.5	2.5	2	-1	1.5	2.5
Au	AA	-2 B	-2 B	-2 B	-2 B	-2 B	-2 B
Co	AA	11	10	12	11	10	8
Cr	AA	17	17	16	21	20	15
Cu	AA	12	7	7	6	6	10
Ni	AA	10	11	10	10	10	10
Pb	AA	-10	-10	-10	-10	-10	-10
Sb	AA	0.2	0.3	0.1	0.1	0.2	0.3
Zn	AA	30	27	26	52	26	19
B	ICP/OES	9	10	4	11	6	5
Be	ICP/OES	-1	-1	-1	-1	-1	-1
Co	ICP/OES	12	9	12	12	11	8
Cu	ICP/OES	10	5	5	4	4	8
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Ni	ICP/OES	19	20	20	19	19	18
Sc	ICP/OES	10	8	11	9	8	10
Sr	ICP/OES	415	300	415	320	400	385
V	ICP/OES	70	45	65	60	55	55
Y	ICP/OES	9	6	10	8	6	8
Zn	ICP/OES	30	24	24	65	23	16
Ga	XRF	18	19	15	16	21	21
Nb	XRF	-5	-5	-5	-5	-5	-5
Rb	XRF	25	5	-5	24	-5	-5
Sn	AA	2.6	2.1	2.9	3.3	2.1	4
Ce	ICP-MS	-35	-35	-35	41	-35	-35

La	ICP-MS	-35	-35	-35	-35	-35	-35

MAJOR OXIDE LISTING

	86RPS-0065	86RPS-0066	86RPS-0067	86RPS-0068	86RPS-0069	86RPS-0070
SiO2	66.10	66.80	67.10	64.90	66.80	66.50
Al2O3	15.60	15.20	16.00	15.40	16.10	15.20
Fe2O3	1.77	0.96	1.21	0.74	1.10	1.74
FeO	2.67	3.11	2.67	3.04	1.85	2.96
MgO	1.13	1.56	1.36	1.31	1.29	1.34
CaO	4.24	3.14	2.70	3.28	4.86	3.02
Na2O	4.66	4.55	5.04	5.66	5.61	4.51
K2O	0.79	0.80	0.70	0.65	0.35	1.01
TiO2	0.45	0.50	0.40	0.44	0.43	0.45
P2O5	0.05	0.08	0.08	0.08	0.09	0.08
MnO	0.06	0.04	0.04	0.04	0.05	0.05
CO2	1.14	1.38	0.67	1.91	0.17	1.57
S	0.01	0.01	0.01	0.01	0.01	0.01
H2O+	0.67	1.16	0.98	1.43	0.53	1.47
H2O-	0.24	0.17	0.13	0.09	0.14	0.05
LOI	2.20	2.70	2.10	3.20	1.10	3.00
TOTAL	99.60	99.50	99.10	99.90	99.40	99.90
S.G.	2.74	2.72	2.71	2.70	2.75	2.72

TRACE ELEMENT LISTING

	METHOD	86RPS-0065	86RPS-0066	86RPS-0067	86RPS-0068	86RPS-0069	86RPS-0070
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	5.5	1	2	2.5	2	-1
Au	AA	-2 B	-2 B	-2 B	-2 B	-2 B	-2 B
Co	AA	10	13	11	10	6	11
Cr	AA	16	16	18	18	18	14
Cu	AA	34	20	10	8	24	24
Ni	AA	11	10	10	10	10	9
Pb	AA	-10	-10	-10	-10	-10	-10
Sb	AA	1.4	0.3	0.7	0.2	0.2	0.1
Zn	AA	30	34	28	32	26	47
B	ICP/OES	9	9	9	8	8	7
Be	ICP/OES	-1	-1	-1	-1	-1	-1
Co	ICP/OES	11	13	11	11	8	12
Cu	ICP/OES	30	18	8	8	22	21
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Ni	ICP/OES	17	17	19	19	18	17
Sc	ICP/OES	9	9	9	9	9	10
Sr	ICP/OES	460	270	360	330	345	225
V	ICP/OES	70	60	55	55	60	64
Y	ICP/OES	9	7	7	6	7	7
Zn	ICP/OES	30	35	25	35	20	55
Ga	XRF	11	20	21	19	16	18
Nb	XRF	-5	-5	-5	-5	-5	-5
Rb	XRF	-5	16	10	7	-5	17
Sn	AA	4.8	7	3.4	2.2	2.4	2.1
Ce	ICP-MS	-35	35	-35	-35	-35	-35

La	ICP-MS	-35	-35	35	-35	-35	-35

MAJOR OXIDE LISTING

	86RPS-0071	86RPS-0072	86RPS-0073	86RPS-0074	86RPS-0075
SiO_2	65.70	65.80	65.00	67.80	65.80
Al_2O_3	15.50	15.90	15.00	15.60	16.90
Fe_2O_3	2.09	1.01	0.59	1.88	0.71
FeO	2.74	2.07	2.52	2.52	2.44
MgO	1.43	1.45	1.48	0.85	1.62
CaO	3.90	3.91	3.88	3.58	2.26
Na_2O	4.54	5.37	5.50	4.84	6.12
K_2O	0.76	0.83	0.80	0.62	0.33
TiO_2	0.48	0.46	0.44	0.40	0.44
P_2O_5	0.10	0.10	0.10	0.10	0.10
MnO	0.06	0.04	0.04	0.03	0.04
CO_2	1.01	1.46	2.28	0.41	0.68
S	0.01	0.01	0.01	0.01	0.01
H_2O+	1.31	1.13	1.06	1.16	1.45
H_2O-	0.05	0.07	0.06	0.08	0.07
LOI	2.30	2.80	3.40	2.50	2.10
TOTAL	99.70	99.60	98.80	99.90	99.00
S.G.	2.75	2.71	2.70	2.75	2.70

TRACE ELEMENT LISTING

	METHOD	86RPS-0071	86RPS-0072	86RPS-0073	86RPS-0074	86RPS-0075
Ag	AA	-2	-2	-2	-2	-2
As	AA	1.5	1.5	2	2.5	2
Au	AA	-2 B	-2 B	3 B	-2 B	-2 B
Co	AA	12	7	7	7	8
Cr	AA	16	18	16	12	19
Cu	AA	20	20	8	30	6
Ni	AA	10	11	10	5	15
Pb	AA	-10	-10	-10	-10	-10
Sb	AA	0.3	0.1	0.2	0.6	0.3
Zn	AA	42	23	25	16	26
B	ICP/OES	8	7	7	11	10
Be	ICP/OES	-1	-1	-1	-1	-1
Co	ICP/OES	13	9	13	13	13
Cu	ICP/OES	19	19	5	25	4
Mo	ICP/OES	-10	-10	-10	-10	-10
Ni	ICP/OES	19	19	19	13	21
Sc	ICP/OES	11	10	8	8	8
Sr	ICP/OES	345	395	335	440	380
V	ICP/OES	70	70	50	45	50
Y	ICP/OES	9	10	6	9	5
Zn	ICP/OES	50	21	24	13	25
Ga	XRF	20	17	22	18	19
Nb	XRF	-5	-5	-5	-5	-5
Rb	XRF	9	17	10	8	-5
Sn	AA	3.1	2.8	3.1	2.1	2.3
Ce	ICP-MS	-35	36	-35	-35	-35

La	ICP-MS	-35	-35	-35	35	-35

MAJOR OXIDE STATISTICS

TOTAL NUMBER OF SAMPLES: 23

	MEAN	STD. DEVIATION
SiO2	66.10	1.02
Al2O3	15.67	0.42
Fe2O3	1.54	0.55
FeO	2.56	0.38
MgO	1.39	0.18
CaO	3.60	0.65
Na2O	5.00	0.54
K2O	0.68	0.30
TiO2	0.44	0.05
P2O5	0.09	0.02
MnO	0.05	0.01
CO2	0.98	0.61
S	0.01	0.01
H2O+	1.08	0.25
H2O-	0.15	0.08
LOI	2.36	0.60
TOTAL	99.38	0.44
S.G.	2.73	0.02

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	23	-2.00	0.00
As	23	2.15	1.47
Au	23	2.96	20.24
Co	23	10.13	2.10
Cr	23	16.96	2.01
Cu	23	27.17	47.87
Ni	23	10.35	1.64
Pb	23	-7.43	8.51
Sb	23	0.50	0.50
Zn	23	33.48	11.40
B	23	8.26	1.98
Be	23	-1.00	0.00
Co	23	11.61	1.78
Cu	23	25.70	50.27
Mo	23	-10.00	0.00
Ni	23	19.00	1.88
Sc	23	9.43	1.04
Sr	23	381.96	70.71
V	23	60.83	8.60
Y	23	7.96	1.52
Zn	23	36.09	17.64
Ga	23	18.30	2.40
Nb	23	-5.00	0.00
Rb	23	7.30	9.14
Sn	23	4.08	3.19
Ce	23	-25.57	24.93
La	23	-28.91	20.17

SAGE
FELSIC INTRUSIVES, HAWK LK., AREA II

MAJOR OXIDE LISTING

	83RPS-0174	83RPS-0175	83RPS-0176	83RPS-0177	83RPS-0178	83RPS-0186
SiO2	66.80	74.60	75.50	71.70	76.40	74.50
Al2O3	17.20	12.80	12.70	14.20	12.30	13.50
Fe2O3	0.67	0.94	0.29	0.58	0.32	0.50
FeO	0.51	0.95	1.16	1.46	0.87	1.02
MgO	0.60	1.59	0.09	0.73	1.61	1.01
CaO	3.26	0.95	1.11	2.01	1.25	1.08
Na2O	4.71	1.66	3.72	3.33	0.33	3.51
K2O	2.32	3.22	2.95	2.40	3.48	2.34
TiO2	0.30	0.26	0.28	0.32	0.27	0.22
P2O5	0.01	0.04	0.04	00.00	0.04	0.03
MnO	0.02	0.02	0.03	0.03	0.02	0.03
CO2	1.85	0.48	0.86	1.10	0.58	0.19
S	0.04	0.01	00.00	00.00	00.00	00.00
H2O+	0.82	0.96	0.49	0.58	1.11	0.62
H2O-	0.08	0.04	0.04	0.04	0.05	0.05
LOI	3.00	2.10	1.80	2.10	2.40	1.60
TOTAL	99.20	98.50	99.30	98.50	98.60	98.60
S.G.	2.70	2.71	2.65	2.71	2.73	2.70

TRACE ELEMENT LISTING

	METHOD	83RPS-0174	83RPS-0175	83RPS-0176	83RPS-0177	83RPS-0178	83RPS-0186
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	1.5M	1 M	-1 M	-1 M	-1 M	-1 M
Au	AA	-2 B	-2 B	2 B	7 B	-2 B	-2 B
Ba	AA	1020	490	520	610	400	700
Co	AA	6	-5	-5	6	-5	-5
Cr	AA	-5	-5	-5	-5	-5	-5
Cu	AA	6	-5	-5	-5	-5	-5
Li	AA	6	16	4	12	10	16
Ni	AA	-5	-5	-5	-5	-5	-5
Pb	AA	-10	-10	13	-10	-10	36
Sb	AA	0.3M	0.1M	-0.1M	-0.1M	0.1M	-0.1M
Zn	AA	37	26	41	42	23	38
B	ICP/OES	12	20	8	13	26	15
Be	ICP/OES	1	1	2	2	1	2
Mo	ICP/OES	-10	10	-10	-10	-10	-10
Sc	ICP/OES	2	6	5	4	5	
Sr	ICP/OES	425	30	65	100	19	95
V	ICP/OES	16	3	2	18	2	6
Y	ICP/OES	3	35	25	21	25	18
Ga	XRF	15	13	11	15	10	13
Nb	XRF	8	12	13	13	13	10
Rb	XRF	52	83	68	83	87	77
Zr	XRF	70	165	155	145	165	165
Sn	XRF	-1	8	4	3	5	-1

Ce	ICP-MS	-35	100	90	70	70	125
La	ICP-MS	8	40	35	30	30	50
Nd	ICP-MS	40	50	45	40	40	55

MAJOR OXIDE LISTING

	83RPS-0187	83RPS-0188	83RPS-0189	82RPS-0118
SiO2	73.00	72.20	73.10	75.10
Al2O3	14.20	14.40	14.50	12.90
Fe2O3	0.60	0.67	0.48	0.76
FeO	1.46	1.46	1.60	1.02
MgO	0.48	0.42	0.89	0.23
CaO	1.96	2.30	1.87	1.11
Na2O	3.19	4.15	4.03	3.61
K2O	3.12	1.74	2.19	3.32
TiO2	0.32	0.29	0.27	0.21
P2O5	00.00	0.01	00.00	0.01
MnO	0.04	0.04	0.04	0.02
CO2	0.11	0.61	0.10	0.80
S	0.01	0.01	00.00	0.01
H2O+	0.62	0.56	0.47	0.47
H2O-	0.05	0.05	0.04	0.03
LOI	1.00	1.30	0.80	1.30
TOTAL	99.20	98.90	99.60	99.60
S.G.	2.68	2.71	2.69	2.86

TRACE ELEMENT LISTING

	METHOD	83RPS-0187	83RPS-0188	83RPS-0189	82RPS-0118
Ag	AA	-2	-2	-2	
As	AA	-1 M	-1 M	-1 M	
Au	AA	-2 B	-2 B	-2 B	
Ba	AA	690	510	520	640
Co	AA	-5	5	6	-5
Cr	AA	5	7	6	-5
Cu	AA	5	8	-5	5
Li	AA	12	8	16	4
Ni	AA	-5	-5	-5	-5
Pb	AA	13	10	-10	170
Sb	AA	-0.1M	-0.1M	-0.1M	
Zn	AA	47	38	38	28
B	ICP/OES	14	12	-5	
Be	ICP/OES	2	2	2	1
Mo	ICP/OES	-10	-10	-10	-10
Sc	ICP/OES	4		4	3
Sr	ICP/OES	145	155	115	65
V	ICP/OES	20	20	22	5
Y	ICP/OES	21	17	19	19
Ga	XRF	11	11	13	
Nb	XRF	12	12	13	9
Rb	XRF	92	65	78	
Zr	XRF	145	135	155	145
Sn	XRF	1	502	2	
Ce	ICP-MS	75	80	75	75
La	ICP-MS	35	35	35	35

Nd	ICP-MS	45	50	45	45

MAJOR OXIDE STATISTICS

TOTAL NUMBER OF SAMPLES: 10

	MEAN	STD. DEVIATION
SiO2	73.29	2.73
Al2O3	13.87	1.42
Fe2O3	0.58	0.20
FeO	1.15	0.34
MgO	0.76	0.52
CaO	1.69	0.73
Na2O	3.22	1.29
K2O	2.71	0.58
TiO2	0.27	0.04
P2O5	0.02	0.02
MnO	0.03	0.01
CO2	0.67	0.53
S	0.01	0.01
H2O+	0.67	0.22
H2O-	0.05	0.01
LOI	1.74	0.68
TOTAL	99.00	0.44
S.G.	2.71	0.06

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	9	-2.00	0.00
As	9	-0.50	1.00
Au	9	-0.56	3.13
Ba	10	610.00	172.63
Co	10	-0.70	5.56
Cr	10	-1.70	5.33
Cu	10	-0.60	5.74
Li	10	10.40	4.79
Ni	10	-5.00	0.00
Pb	10	19.20	55.22
Sb	9	-0.01	0.15
Zn	10	35.80	7.66
B	9	12.78	8.47
Be	10	1.60	0.52
Mo	10	-8.00	6.32
Sc	8	4.12	1.25
Sr	10	121.40	115.59
V	10	11.40	8.45
Y	10	20.30	8.03
Ga	9	12.44	1.81
Nb	10	11.50	1.84
Rb	9	76.11	12.45
Zr	10	144.50	28.13
Sn	9	58.11	166.48
Ce	10	72.50	41.45
La	10	33.30	10.54
Nd	10	45.50	4.97

SAGE
FELSIC INTRUSIVE, LUND LK. STOCK, AREA II

MAJOR OXIDE LISTING

	84RPS-0046	84RPS-0047	84RPS-0078
SiO2	71.30	69.80	70.50
Al2O3	15.20	15.30	15.10
Fe2O3	0.33	0.44	0.46
FeO	1.54	2.05	1.46
MgO	00.00	0.08	0.01
CaO	1.06	1.21	1.11
Na2O	4.26	4.69	4.04
K2O	4.38	4.83	4.49
TiO2	0.08	0.16	0.11
P2O5	00.00	00.00	00.00
MnO	0.06	0.09	0.05
CO2	0.41	0.51	0.75
S	0.01	0.01	0.06
H2O+	0.79	0.47	0.71
H2O-	0.02	0.01	0.01
LOI	0.70	0.50	1.00
TOTAL	99.40	99.60	98.90
S.G.	2.64	2.65	2.65

TRACE ELEMENT LISTING

	METHOD	84RPS-0046	84RPS-0047	84RPS-0078
Ag	AA	-2	-2	-2
As	AA	-1 M	-1 M	1 M
Au	AA	-2 B	3 B	7 B
Ba	AA	670	630	700
Co	AA	-5	-5	-5
Cr	AA	-10	-10	-10
Cu	AA	11	12	8
Li	AA	18	27	16
Ni	AA	-5	-5	-5
Pb	AA	11	15	20
Sb	AA	0.2M	0.2M	0.4M
Zn	AA	46	93	94
B	ICP/OES	4	4	4
Be	ICP/OES	3	4	3
Mo	ICP/OES	-10	-10	-10
Sc	ICP/OES	-2	-2	-2
Sr	ICP/OES	95	180	100
V	ICP/OES	-5	-5	-5
Y	ICP/OES	30	25	25
Ga	XRF	14	18	18
Rb	XRF	155	195	165
Zr	XRF	145	165	
Sn	ICP-MS	42	22	39
Ce	ICP-MS	110	125	140

La	ICP-MS	-35	50	-35
Nd	ICP-MS	25	30	40

```
MAJOR OXIDE STATISTICS

TOTAL NUMBER OF SAMPLES:          3


              MEAN    STD. DEVIATION
SiO2         70.53         0.75
Al2O3        15.20         0.10
Fe2O3         0.41         0.07
FeO           1.68         0.32
MgO           0.03         0.04
CaO           1.13         0.08
Na2O          4.33         0.33
K2O           4.57         0.23
TiO2          0.12         0.04
P2O5          0.00         0.00
MnO           0.07         0.02
CO2           0.56         0.17
S             0.03         0.03
H2O+          0.66         0.17
H2O-          0.01         0.01
LOI           0.73         0.25
TOTAL        99.30         0.36
S.G.          2.65         0.01
```

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	3	-2.00	0.00
As	3	-0.33	1.15
Au	3	2.67	4.51
Ba	3	666.67	35.12
Co	3	-5.00	0.00
Cr	3	-10.00	0.00
Cu	3	10.33	2.08
Li	3	20.33	5.86
Ni	3	-5.00	0.00
Pb	3	15.33	4.51
Sb	3	0.27	0.12
Zn	3	77.67	27.43
B	3	4.00	0.00
Be	3	3.33	0.58
Mo	3	-10.00	0.00
Sc	3	-2.00	0.00
Sr	3	125.00	47.70
V	3	-5.00	0.00
Y	3	26.67	2.89
Ga	3	16.67	2.31
Rb	3	171.67	20.82
Zr	2	155.00	14.14
Sn	3	34.33	10.79
Ce	3	125.00	15.00
La	3	-6.67	49.07
Nd	3	31.67	7.64

SAGE
FELSIC INTRUSIVES, MIDDLETON LK. INTRUSIONS, AREA II

MAJOR OXIDE LISTING

	81RPS-0186	81RPS-0187	81RPS-0188	86RPS-0076	86RPS-0077	86RPS-0078
SiO2	75.10	73.50	76.00	77.80	75.60	76.80
Al2O3	12.90	15.30	13.80	13.60	13.70	13.60
Fe2O3	0.22	0.89	0.56	0.44	0.62	0.32
FeO	0.66	0.80	0.66	0.30	0.44	0.37
MgO	0.26	0.33	0.32	0.03	0.11	0.38
CaO	2.36	1.14	1.10	0.67	0.85	0.72
Na2O	3.49	3.09	4.54	3.78	5.76	2.96
K2O	1.45	2.12	1.10	2.03	1.32	2.68
TiO2	0.09	0.14	0.13	0.04	0.02	0.05
P2O5	0.04	0.04	0.04	0.02	0.01	0.02
MnO	0.06	0.04	0.08	0.03	0.03	0.02
CO2	2.10	0.93	1.05	0.35	0.58	0.62
S	0.01	0.01	0.01	0.02	0.17	0.09
H2O+	0.98	1.56	1.03	0.48	0.13	0.65
H2O-	0.11	0.13	0.09	0.05	0.07	0.05
LOI	3.00	2.70	2.20	1.30	1.00	1.60
TOTAL	99.83	100.02	100.51	99.60	99.40	99.30
S.G.	2.66	2.67	2.64	2.67	2.65	2.68

TRACE ELEMENT LISTING

	METHOD	81RPS-0186	81RPS-0187	81RPS-0188	86RPS-0076	86RPS-0077	86RPS-0078
Ag	AA				-2	-2	-2
As	AA				2	2.5	2.5
Au	AA				-2 B	7 B	-2 B
Ba	AA	330	580	310			
Co	AA	-5	-5	-5	-5	-5	-5
Cr	AA	-5	-5	9	-10	-10	-10
Cu	AA	6	6	5	10	8	6
Li	AA	10	12	8			
Ni	AA	-5	-5	-5	-5	-5	-5
Pb	AA	36	225	355	-10	-10	-10
Sb	AA				0.2	0.7	0.3
Zn	AA	29	25	22	16	41	14
B	ICP/OES				35	17	40
Be	ICP/OES	1	1	1	-1	-1	1
Co	ICP/OES				4	4	4
Cu	ICP/OES				8	6	3
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Ni	ICP/OES				2	3	3
Sc	ICP/OES	3	1	3	4	4	4
Sr	ICP/OES	70	25	65	45	40	25
V	ICP/OES	3	4	9	2	-1	-1
Y	ICP/OES	4	-1	5	10	12	5
Zn	ICP/OES				16	50	13
Ga	XRF				14	17	15

Nb	XRF	2	-1	5	6	7	6
Rb	XRF	30	40	20	44	24	44
Zr	XRF	55	35	50			
Sn	AA				3.5	5.2	2
Ce	ICP-MS				-35	-35	-35

La	ICP-MS	-35	-35	-35

MAJOR OXIDE LISTING

	86RPS-0079	86RPS-0080	86RPS-0081	86RPS-0082	86RPS-0083	86RPS-0084
SiO2	76.30	72.50	73.80	73.60	73.40	73.10
Al2O3	13.30	14.80	14.50	14.60	14.90	14.70
Fe2O3	0.09	0.58	0.42	0.93	0.89	0.68
FeO	0.52	1.41	1.18	1.18	1.63	1.26
MgO	0.10	0.11	0.07	0.10	0.15	0.18
CaO	0.86	2.02	1.62	2.25	1.53	2.25
Na2O	5.15	5.24	5.35	4.71	5.29	5.01
K2O	1.29	0.88	1.15	1.04	0.87	1.00
TiO2	00.00	0.05	0.10	0.09	0.05	0.04
P2O5	0.01	0.01	0.01	0.02	0.01	00.00
MnO	0.02	0.05	0.05	0.07	0.06	0.07
CO2	0.86	1.01	0.73	0.20	0.11	0.39
S	0.04	0.01	0.01	0.01	0.01	0.01
H2O+	0.36	0.65	0.63	0.61	1.06	0.67
H2O-	0.05	0.05	0.11	0.07	0.06	0.05
LOI	1.20	1.70	1.40	1.00	1.00	1.00
TOTAL	99.00	99.40	99.70	99.50	100.00	99.40
S.G.	2.65	2.69	2.68	2.71	2.69	2.70

TRACE ELEMENT LISTING

	METHOD	86RPS-0079	86RPS-0080	86RPS-0081	86RPS-0082	86RPS-0083	86RPS-0084
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	1	-1	-1	-1	-1	-1
Au	AA	-2 B	-2 B	-2 B	-2 B	-2 B	-2 B
Co	AA	-5	-5	-5	-5	-5	-5
Cr	AA	-10	-10	-10	-10	-10	-10
Cu	AA	-5	-5	5	5	5	5
Ni	AA	-5	-5	-5	-5	-5	-5
Pb	AA	-10	-10	-10	-10	-10	-10
Sb	AA	0.2	-0.1	0.1	0.5	-0.1	0.3
Zn	AA	10	36	41	35	41	39
B	ICP/OES	19	5	10	6	9	5
Be	ICP/OES	-1	-1	-1	-1	-1	-1
Co	ICP/OES	4	6	5	6	7	6
Cu	ICP/OES	-1	2	4	4	3	2
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Ni	ICP/OES	3	5	4	5	5	4
Sc	ICP/OES	3	2	2	2	2	2
Sr	ICP/OES	25	275	255	285	245	280
V	ICP/OES	-1	3	2	3	4	3
Y	ICP/OES	7	5	4	6	6	5
Zn	ICP/OES	10	40	55	40	55	45
Ga	XRF	14	15	15	13	12	16
Nb	XRF	5	-5	-5	-5	-5	-5
Rb	XRF	16	15	18	12	12	13
Sn	AA	2	2.6	3.4	4.3	3.1	3.2
Ce	ICP-MS	-35	-35	-35	-35	-35	-35

La	ICP-MS	-35	-35	-35	-35	-35	-35

MAJOR OXIDE LISTING

	86RPS-0085	86RPS-0086	86RPS-0087	86RPS-0088	86RPS-0089	86RPS-0090
SiO2	73.30	73.10	72.80	72.40	73.30	72.90
Al2O3	14.80	14.30	15.00	14.40	14.80	14.60
Fe2O3	0.82	0.91	0.45	0.72	0.96	0.78
FeO	1.11	1.18	1.65	1.41	1.26	1.33
MgO	0.05	0.09	0.12	0.15	0.09	0.17
CaO	1.41	2.35	1.92	1.97	2.29	1.93
Na2O	4.44	5.23	4.67	4.77	4.80	5.00
K2O	1.46	0.66	1.01	1.04	0.88	0.95
TiO2	0.08	0.09	0.11	0.05	0.06	0.07
P2O5	0.01	0.01	0.02	0.01	0.01	0.01
MnO	0.04	0.05	0.05	0.05	0.06	0.05
CO2	0.76	0.14	0.48	0.68	0.29	0.51
S	00.00	0.01	0.01	0.01	0.01	0.01
H2O+	0.92	0.70	0.91	0.84	0.68	0.97
H2O-	0.06	0.05	0.07	0.05	0.05	0.05
LOI	1.80	0.90	1.30	1.60	1.10	1.20
TOTAL	99.30	98.90	99.30	98.60	99.50	99.30
S.G.	2.68	2.71	2.69	2.69	2.70	2.70

TRACE ELEMENT LISTING

	METHOD	86RPS-0085	86RPS-0086	86RPS-0087	86RPS-0088	86RPS-0089	86RPS-0090
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	-1	-1	-1	-1	1	-1
Au	AA	-2 B	-2 B	-2 B	-2 B	5 B	-2 B
Co	AA	-5	-5	-5	-5	-5	-5
Cr	AA	-10	-10	-10	-10	-10	-10
Cu	AA	-5	-5	-5	-5	-5	-5
Ni	AA	-5	-5	-5	-5	-5	-5
Pb	AA	-10	-10	-10	-10	-10	-10
Sb	AA	0.1	0.3	0.2	0.1	0.1	0.5
Zn	AA	32	36	31	34	40	40
B	ICP/OES	8	8	6	9	6	8
Be	ICP/OES	-1	-1	-1	-1	-1	-1
Co	ICP/OES	6	6	6	6	6	6
Cu	ICP/OES	2	3	2	3	3	3
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Ni	ICP/OES	4	5	5	5	5	5
Sc	ICP/OES	2	2	2	2	2	2
Sr	ICP/OES	215	225	255	325	285	305
V	ICP/OES	3	3	4	3	4	4
Y	ICP/OES	5	7	6	5	7	7
Zn	ICP/OES	40	45	40	35	55	55
Ga	XRF	13	16	15	14	12	17
Nb	XRF	-5	-5	-5	-5	-5	-5
Rb	XRF	26	8	13	16	13	16
Sn	AA	2.1	2.6	2.6	2.3	2.6	5.8
Ce	ICP-MS	-35	-35	-35	-35	-35	-35

La	ICP-MS	-35	-35	-35	-35	-35	-35

MAJOR OXIDE LISTING

	86RPS-0092
SiO_2	65.40
Al_2O_3	15.10
Fe_2O_3	1.01
FeO	2.67
MgO	1.32
CaO	3.76
Na_2O	4.66
K_2O	0.62
TiO_2	0.44
P_2O_5	0.04
MnO	0.04
CO_2	2.38
S	0.01
H_2O+	1.59
H_2O-	0.06
LOI	3.70
TOTAL	99.10
S.G.	2.71

TRACE ELEMENT LISTING

	METHOD	86RPS-0092	
Ag	AA	-2	
As	AA	1.5	
Au	AA	-2	B
Co	AA	11	
Cr	AA	17	
Cu	AA	16	
Ni	AA	10	
Pb	AA	-10	
Sb	AA	0.2	
Zn	AA	32	
B	ICP/OES	10	
Be	ICP/OES	-1	
Co	ICP/OES	16	
Cu	ICP/OES	13	
Mo	ICP/OES	-10	
Ni	ICP/OES	20	
Sc	ICP/OES	8	
Sr	ICP/OES	420	
V	ICP/OES	55	
Y	ICP/OES	5	
Zn	ICP/OES	40	
Ga	XRF	18	
Nb	XRF	-5	
Rb	XRF	10	
Sn	AA	4.5	
Ce	ICP-MS	-35	

La ICP-MS -35

MAJOR OXIDE STATISTICS

TOTAL NUMBER OF SAMPLES: 19

	MEAN	STD. DEVIATION
SiO2	73.72	2.57
Al2O3	14.35	0.67
Fe2O3	0.65	0.27
FeO	1.11	0.57
MgO	0.22	0.28
CaO	1.74	0.77
Na2O	4.63	0.77
K2O	1.24	0.53
TiO2	0.09	0.09
P2O5	0.02	0.01
MnO	0.05	0.02
CO2	0.75	0.60
S	0.02	0.04
H2O+	0.81	0.36
H2O-	0.07	0.02
LOI	1.62	0.77
TOTAL	99.46	0.43
S.G.	2.68	0.02

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	16	-2.00	0.00
As	16	0.03	1.43
Au	16	-1.00	2.76
Ba	3	406.67	150.44
Co	19	-4.16	3.67
Cr	19	-7.05	7.36
Cu	19	1.95	6.59
Li	3	10.00	2.00
Ni	19	-4.21	3.44
Pb	19	24.00	96.78
Sb	16	0.22	0.21
Zn	19	31.26	9.65
B	16	12.56	10.53
Be	19	-0.58	0.84
Co	16	6.12	2.80
Cu	16	3.75	3.13
Mo	19	-10.00	0.00
Ni	16	5.19	4.07
Sc	19	2.74	1.52
Sr	19	192.89	126.08
V	19	5.58	12.18
Y	19	5.79	2.57
Zn	16	39.62	14.78
Ga	16	14.75	1.77
Nb	19	-1.58	4.88
Rb	19	20.53	11.29
Zr	3	46.67	10.41
Sn	16	3.24	1.16
Ce	16	-35.00	0.00
La	16	-35.00	0.00

SAGE
FELSIC VOLCANICS, AREA II

MAJOR OXIDE LISTING

	83RPS-0200	83RPS-0201	83RPS-0202	83RPS-0203	83RPS-0204	83RPS-0205
SiO_2	64.70	62.60	65.20	60.20	65.60	73.60
Al_2O_3	15.50	17.00	13.80	14.80	13.80	13.40
Fe_2O_3	2.23	2.14	0.88	1.52	1.41	0.32
FeO	1.16	2.04	3.05	3.93	2.47	1.46
MgO	0.79	1.43	1.76	3.34	1.97	0.54
CaO	5.69	5.84	4.45	6.53	2.90	2.03
Na_2O	3.58	3.28	2.21	2.03	2.18	5.72
K_2O	1.85	1.60	2.04	1.15	3.10	0.56
TiO_2	0.56	0.70	0.57	0.72	0.55	0.23
P_2O_5	0.02	0.05	0.24	0.04	0.03	00.00
MnO	0.08	0.06	0.07	0.08	0.05	0.07
CO_2	1.44	0.55	2.78	2.57	3.52	1.42
S	0.13	0.04	00.00	0.01	00.00	00.00
H_2O+	0.95	1.12	2.07	2.46	1.47	0.51
H_2O-	0.05	0.04	0.04	0.05	0.05	0.02
LOI	2.80	2.50	4.80	5.00	5.20	2.20
TOTAL	98.70	98.50	99.20	99.40	99.10	99.90
S.G.	2.80	2.82	2.74	2.80	2.75	2.67

TRACE ELEMENT LISTING

	METHOD	83RPS-0200	83RPS-0201	83RPS-0202	83RPS-0203	83RPS-0204	83RPS-0205
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	5.5M	4 M	1.5M	2.5M	-1 M	-1 M
Au	AA	-2 B	-2 B	-2 B	-2 B	-2 B	-2 B
Ba	AA	290	180	190	260	420	140
Co	AA	16	16	13	20	12	-5
Cr	AA	42	36	13	108	24	-5
Cu	AA	24	24	10	44	25	-5
Li	AA	14	20	16	17	10	11
Ni	AA	20	23	21	67	18	-5
Pb	AA	-10	-10	12	12	10	31
Sb	AA	0.8M	0.3M	0.1M	0.1M	-0.1M	-0.1M
Zn	AA	72	62	54	67	52	50
B	ICP/OES	-5	0.0	19	13	20	16
Be	ICP/OES	1	1	1	1	1	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	11	13	10	17	9	1
Sr	ICP/OES	245	340	190	310	75	105
V	ICP/OES	55	75	60	105	55	1
Y	ICP/OES	9	14	19	12	8	7
Ga	XRF	15	17	13	17	15	10
Nb	XRF	12	15	14	18	12	4
Rb	XRF	47	57	55	33	61	14
Zr	XRF	95	115	130	70	130	95
Sn	XRF	2	2	2	2	1	-1

Ce	ICP-MS	60	75	85	70	65	45
La	ICP-MS	25	35	40	35	30	15
Nd	ICP-MS	70	80	80	85	55	35

MAJOR OXIDE LISTING

	83RPS-0206	83RPS-0207	83RPS-0208	84RPS-0036	84RPS-0037	84RPS-0038
SiO2	73.70	74.90	66.10	72.90	74.10	72.10
Al2O3	14.40	13.70	15.90	13.30	14.70	14.70
Fe2O3	0.37	0.25	1.11	1.00	0.40	0.71
FeO	1.24	1.67	2.47	2.23	0.77	1.46
MgO	0.46	0.53	1.52	0.83	0.11	0.50
CaO	1.96	1.01	3.57	1.96	1.47	1.68
Na2O	5.53	5.79	2.25	5.49	6.24	6.1[illegible]
K2O	0.66	0.49	1.73	0.12	0.80	0.52
TiO2	0.27	0.21	0.65	0.26	0.26	0.26
P2O5	00.00	00.00	0.05	00.00	00.00	0.01
MnO	0.05	0.05	0.05	0.17	0.08	0.14
CO2	0.33	0.57	1.45	0.35	0.23	0.31
S	00.00	00.00	0.01	0.01	0.01	0.01
H2O+	0.62	0.70	1.92	0.90	0.42	0.68
H2O-	0.04	0.04	0.05	0.01	00.00	0.01
LOI	1.00	1.40	3.60	0.90	0.40	0.60
TOTAL	99.60	99.90	98.80	99.50	99.60	99.20
S.G.	2.69	2.67	2.76	2.69	2.67	2.61

TRACE ELEMENT LISTING

	METHOD	83RPS-0206	83RPS-0207	83RPS-0208	84RPS-0036	84RPS-0037	84RPS-0038
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	-1 M	-1 M	-1 M	2 M	1.5M	2 M
Au	AA	2 B	-2 B	8 B	16 B	9 B	25 B
Ba	AA	210	150	150	60	760	280
Co	AA	-5	-5	11	-5	-5	-5
Cr	AA	-5	-5	72	-10	-10	-10
Cu	AA	-5	8	38	6	-5	-5
Li	AA	8	16	10	7	4	6
Ni	AA	-5	-5	14	-5	-5	-5
Pb	AA	-10	28	-10	-10	-10	14
Sb	AA	-0.1M	-0.1M	-0.1M	0.4M	0.7M	2.6M
Zn	AA	40	81	49	62	22	34
B	ICP/OES	14	17	22	3	16	14
Be	ICP/OES	1	-1	1	1	1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	2	1	13	2	2	2
Sr	ICP/OES	325	150	235	150	185	200
V	ICP/OES	3	1	90	7	7	-5
Y	ICP/OES	10	8	10	6	6	6
Ga	XRF	11	10	17	7	6	11
Nb	XRF	7	5	12			
Rb	XRF	18	14	61	-5	7	-5
Zr	XRF	70	100	70	115	125	125
Sn	XRF	1	-1	2			
Sn	ICP-MS				29	24	18
Ce	ICP-MS	70	50	55	55	50	65

La	ICP-MS	23	21	25	-35	-35	-35
Nd	ICP-MS	50	30	60	22	21	23

MAJOR OXIDE LISTING

	84RPS-0039	84RPS-0040	84RPS-0041	84RPS-0042	84RPS-0043	84RPS-0044
SiO2	74.30	73.10	73.00	76.60	71.00	70.30
Al2O3	14.60	14.60	15.50	13.20	16.50	16.60
Fe2O3	0.31	0.54	0.40	0.89	1.74	1.67
FeO	0.51	0.68	0.86	0.17	1.20	1.11
MgO	0.06	0.10	0.28	0.16	0.39	0.34
CaO	1.50	1.89	1.21	4.27	1.32	1.33
Na2O	6.37	6.56	6.62	3.83	0.06	0.07
K2O	0.50	0.35	0.66	0.47	4.75	4.76
TiO2	0.27	0.25	0.30	0.23	0.47	0.46
P2O5	0.01	00.00	0.02	0.01	0.11	0.11
MnO	0.05	0.11	0.23	0.08	0.09	0.09
CO2	0.31	0.09	0.04	0.25	0.04	0.08
S	0.01	0.02	0.01	0.01	0.07	0.09
H2O+	0.26	0.22	0.55	0.18	1.83	2.03
H2O-	00.00	0.02	0.02	0.01	0.03	0.03
LOI	0.50	0.30	0.30	0.40	2.20	2.30
TOTAL	99.10	98.50	99.70	100.30	99.60	99.00
S.G.	2.67	2.68	2.67	2.73	2.78	2.81

TRACE ELEMENT LISTING

	METHOD	84RPS-0039	84RPS-0040	84RPS-0041	84RPS-0042	84RPS-0043	84RPS-0044
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	1.5M	-1 M	-1 M	-1 M	-1 M	-1 M
Au	AA	5 B	4 B	3 B	4 B	9 B	2 B
Ba	AA	180	150	220	180	990	940
Co	AA	-5	-5	-5	-5	-5	-5
Cr	AA	-10	-10	-10	-10	-10	-10
Cu	AA	-5	-5	5	-5	-5	5
Li	AA	4	6	14	6	9	10
Ni	AA	-5	-5	-5	-5	-5	-5
Pb	AA	-10	-10	-10	-10	-10	-10
Sb	AA	0.4M	0.2M	0.1M	0.2M	0.3M	0.6M
Zn	AA	24	26	18	18	18	20
B	ICP/OES	9	8	5	6	27	28
Be	ICP/OES	1	1	1	1	3	3
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	-2	2	2	-2	4	4
Sr	ICP/OES	180	195	45	270	215	220
V	ICP/OES	7	6	6	5	22	22
Y	ICP/OES	6	5	7	6	8	8
Ga	XRF	-5	6	11	8	15	15
Rb	XRF	-5	6	9	-5	100	100
Zr	XRF	120	120	120	125	135	130
Sn	ICP-MS	12	20	19	16	29	24
Ce	ICP-MS	47	80	70	50	65	70
La	ICP-MS	-35	-35	-35	-35	-35	-35
Nd	ICP-MS	-20	-20	-20	-20	-20	-20

MAJOR OXIDE LISTING

	84RPS-0045	82RPS-0081	82RPS-0082	82RPS-0083	82RPS-0084	82RPS-0085
SiO2	68.90	69.90	71.00	73.20	71.60	66.00
Al2O3	15.60	15.50	14.90	14.90	16.90	17.00
Fe2O3	1.66	1.58	0.86	0.94	1.04	1.18
FeO	1.03	1.68	1.39	1.46	1.39	2.48
MgO	0.53	1.24	0.30	0.43	0.82	1.06
CaO	4.66	1.71	2.75	1.84	0.38	4.52
Na2O	00.00	2.40	4.66	4.65	1.54	2.48
K2O	3.93	2.58	1.17	0.96	2.71	1.76
TiO2	0.42	0.35	0.14	0.14	0.17	0.39
P2O5	0.03	0.04	0.02	0.02	0.03	0.04
MnO	0.14	0.03	0.06	0.05	0.04	0.04
CO2	1.41	0.80	0.91	0.17	0.24	1.06
S	0.01	0.01	0.01	0.01	0.01	0.01
H2O+	1.27	1.75	0.81	0.86	2.08	1.52
H2O-	0.04	0.05	0.04	0.05	0.07	0.08
LOI	3.40	2.60	1.50	1.00	2.20	2.70
TOTAL	99.60	99.62	99.02	99.68	99.02	99.62
S.G.	2.76	2.73	2.71	2.71	2.73	2.77

TRACE ELEMENT LISTING

	METHOD	84RPS-0045	82RPS-0081	82RPS-0082	82RPS-0083	82RPS-0084	82RPS-0085
Ag	AA	-2					
As	AA	-1 M					
Au	AA	-2 B					
Ba	AA	680	430	340	260	470	200
Co	AA	-5	5	-5	-5	-5	7
Cr	AA	-10	-5	-5	-5	-5	-5
Cu	AA	-5	-5	-5	7	-5	-5
Li	AA	10	10	9	12	20	12
Ni	AA	-5	-5	-5	-5	-5	-5
Pb	AA	-10	45	10	-10	-10	130
Sb	AA	0.2M					
Zn	AA	27	49	38	48	89	60
B	ICP/OES	20					
Be	ICP/OES	1	1	1	1	2	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	5	5	-1	-1	1	4
Sr	ICP/OES	315	260	205	235	345	380
V	ICP/OES	30	35	3	3	3	45
Y	ICP/OES	7	10	5	4	2	8
Ga	XRF	15					
Nb	XRF		4	6	6	4	7
Rb	XRF	90					
Zr	XRF	145	80	50	35	85	10
Sn	ICP-MS	28	28	28	28	28	28
Ce	ICP-MS	42	42	42	42	42	42
La	ICP-MS	-35	-35	-35	-35	-35	-35

Nd	ICP-MS	-20	-20	-20	-20	-20	-20

MAJOR OXIDE LISTING

	82RPS-0086	82RPS-0087	82RPS-0088	82RPS-0089	82RPS-0090	82RPS-0120
SiO2	59.60	68.40	72.80	64.00	63.30	64.20
Al2O3	16.90	15.60	13.40	15.60	16.60	16.90
Fe2O3	0.93	1.78	1.33	2.84	1.81	1.10
FeO	2.78	2.48	1.17	2.12	2.99	6.65
MgO	2.51	1.25	0.51	0.31	2.13	1.82
CaO	5.86	2.85	3.77	4.70	4.41	2.40
Na2O	3.25	3.68	3.84	3.64	5.02	0.02
K2O	2.29	1.30	0.71	2.58	0.33	0.40
TiO2	0.33	0.45	0.32	0.47	0.49	1.11
P2O5	0.03	0.04	0.02	0.04	0.05	0.03
MnO	0.07	0.06	0.06	0.10	0.07	0.16
CO2	3.34	0.63	0.84	2.35	1.00	2.36
S	0.01	0.01	0.01	0.02	0.01	0.05
H2O+	1.99	1.44	0.69	0.84	1.55	2.54
H2O-	0.06	0.05	0.06	0.06	0.07	0.05
LOI	5.10	2.20	1.60	3.10	2.50	3.80
TOTAL	99.95	100.02	99.53	99.67	99.83	99.79
S.G.	2.75	2.75	2.73	2.78	2.75	2.88

TRACE ELEMENT LISTING

	METHOD	82RPS-0086	82RPS-0087	82RPS-0088	82RPS-0089	82RPS-0090	82RPS-0120
Ba	AA	830	320	120	290	120	180
Co	AA	14	9	-5	11	13	28
Cr	AA	75	23	-5	22	26	314
Cu	AA	19	8	14	18	17	46
Li	AA	14	15	7	10	20	49
Ni	AA	39	12	-5	17	19	64
Pb	AA	42	260	135	85	107	149
Zn	AA	77	57	40	89	60	67
Be	ICP/OES	2	1	-1	3	4	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	10	7	2	7	8	11
Sr	ICP/OES	200	175	370	325	450	30
V	ICP/OES	60	60	25	60	65	175
Y	ICP/OES	2	6	5	6	4	-1
Nb	XRF	8	8	6	8	7	12
Zr	XRF	2	50	50	18	14	40
Sn	ICP-MS	28	28	28	28	28	28
Ce	ICP-MS	42	42	42	42	42	42
La	ICP-MS	-35	-35	-35	-35	-35	-35
Nd	ICP-MS	-20	-20	-20	-20	-20	-20

```
                    MAJOR OXIDE STATISTICS

                    TOTAL NUMBER OF SAMPLES:          30


                       MEAN    STD. DEVIATION
          SiO2        69.23          4.72
          Al2O3       15.19          1.24
          Fe2O3        1.16          0.64
          FeO          1.87          1.24
          MgO          0.93          0.81
          CaO          3.02          1.70
          Na2O         3.64          2.08
          K2O          1.56          1.29
          TiO2         0.40          0.21
          P2O5         0.04          0.05
          MnO          0.08          0.04
          CO2          1.05          1.02
          S            0.02          0.03
          H2O+         1.21          0.69
          H2O-         0.04          0.02
          LOI          2.27          1.49
          TOTAL       99.43          0.45
          S.G.         2.74          0.06
```

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	19	-2.00	0.00
As	19	0.50	2.02
Au	19	3.74	7.26
Ba	30	333.00	253.64
Co	30	3.00	10.04
Cr	30	20.33	63.08
Cu	30	8.43	15.53
Li	30	12.53	8.25
Ni	30	7.30	20.06
Pb	30	30.67	65.15
Sb	19	0.34	0.61
Zn	30	49.00	21.55
B	19	13.26	8.87
Be	30	1.17	1.09
Mo	30	-10.00	0.00
Sc	30	4.97	4.95
Sr	30	230.83	100.01
V	30	36.20	40.17
Y	30	7.10	3.74
Ga	19	11.26	5.39
Nb	20	8.75	4.04
Rb	19	34.32	36.30
Zr	30	85.63	43.07
Sn	9	1.11	1.27
Sn	21	25.10	5.01
Ce	30	54.37	1[illegible].65
La	30	-16.20	29.51
Nd	30	8.37	38.39

SAGE
MAFIC INTRUSIVES, AREA II

MAJOR OXIDE LISTING

	83RPS-0209	83RPS-0210	83RPS-0211	83RPS-0212	82RPS-0109	82RPS-0110
SiO2	48.60	45.80	45.90	46.40	45.80	45.40
Al2O3	13.40	12.20	11.10	11.90	11.30	13.20
Fe2O3	4.97	1.75	1.41	2.13	3.01	3.61
FeO	9.75	8.51	10.60	10.40	8.76	9.64
MgO	5.64	4.19	4.11	4.65	12.30	9.74
CaO	9.79	7.43	7.96	6.93	12.90	9.15
Na2O	2.10	4.66	1.22	0.71	0.43	1.91
K2O	0.02	0.04	0.50	0.10	0.02	0.02
TiO2	1.64	1.49	1.16	1.34	0.53	0.86
P2O5	0.02	0.02	0.01	0.02	0.01	0.03
MnO	0.30	0.16	0.19	0.17	0.19	0.16
CO2	1.23	11.40	14.60	11.20	0.17	0.84
S	0.02	0.03	0.18	0.05	0.05	0.06
H2O+	2.19	1.99	1.81	3.51	3.10	3.66
H2O-	0.03	0.07	0.06	0.11	0.08	0.09
LOI	3.10	11.50	15.00	12.60	2.40	3.70
TOTAL	99.70	99.70	100.80	99.60	98.65	98.37
S.G.	3.03	2.99	3.00	3.07	3.09	2.99

TRACE ELEMENT LISTING

	METHOD	83RPS-0209	83RPS-0210	83RPS-0211	83RPS-0212	82RPS-0109	82RPS-0110
Ag	AA	-2	-2	-2	-2		
As	AA	3 M	2.5M	58 M	4 M		
Au	AA	-2 B	-2 B	3 B	-2 B		
Ba	AA	40	120	140	60	40	30
Co	AA	41	33	46	35	59	51
Cr	AA	114	67	43	66	312	217
Cu	AA	34	45	121	64	106	63
Li	AA	10	44	36	46	8	16
Ni	AA	54	31	53	36	200	154
Pb	AA	-10	15	17	36	450	82
Sb	AA	0.4M	1 M	2.5M	0.8M		
Zn	AA	175	68	150	155	72	66
B	ICP/OES	-5		18	26		
Be	ICP/OES	1	1	2	1	-1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	40	45	35	45	35	40
Sr	ICP/OES	145	120	130	100	110	100
V	ICP/OES	325	310	275	285	260	280
Y	ICP/OES	23	8	7	6	3	5
Ga	XRF	26	15	20	16		
Nb	XRF	35	30	30	30	17	18
Rb	XRF	5	7	18	7		
Zr	XRF	50	40	50	45	4	25
Sn	XRF	2	2	3	4		

Ce	ICP-MS	65	60	65	65	65	65
La	ICP-MS	70	55	60	70	70	70
Nd	ICP-MS	100	90	95	95	95	95

MAJOR OXIDE LISTING

	82RPS-0111	82RPS-0112	82RPS-0121
SiO2	44.60	45.40	45.70
Al2O3	12.90	11.50	11.00
Fe2O3	3.29	2.52	2.64
FeO	8.76	9.20	7.52
MgO	12.00	13.10	13.80
CaO	11.30	11.90	8.27
Na2O	0.98	0.58	2.30
K2O	00.00	0.02	1.57
TiO2	0.63	0.53	0.62
P2O5	0.02	0.01	0.12
MnO	0.18	0.17	0.16
CO2	0.35	0.12	2.37
S	0.04	0.01	0.01
H2O+	4.02	3.20	3.09
H2O-	0.08	0.08	0.06
LOI	3.90	3.00	4.20
TOTAL	99.15	98.34	99.23
S.G.	3.05	3.06	2.90

TRACE ELEMENT LISTING

	METHOD	82RPS-0111	82RPS-0112	82RPS-0121
Ba	AA	40	40	370
Co	AA	64	58	46
Cr	AA	331	187	1210
Cu	AA	48	29	52
Li	AA	14	12	34
Ni	AA	220	168	345
Pb	AA	235	142	83
Zn	AA	85	56	88
Be	ICP/OES	-1	-1	3
Mo	ICP/OES	-10	-10	-10
Sc	ICP/OES	30	35	21
Sr	ICP/OES	115	70	290
V	ICP/OES	260	235	180
Y	ICP/OES	2	2	8
Nb	XRF	16	17	18
Zr	XRF	2	5	50
Ce	ICP-MS	65	65	65
La	ICP-MS	70	70	70
Nd	ICP-MS	95	95	95

```
                    MAJOR OXIDE STATISTICS

                    TOTAL NUMBER OF SAMPLES:              9


                       MEAN   STD. DEVIATION
          SiO2        45.96          1.10
          Al2O3       12.06          0.92
          Fe2O3        2.81          1.07
          FeO          9.24          0.97
          MgO          8.84          4.14
          CaO          9.51          2.11
          Na2O         1.65          1.32
          K2O          0.25          0.52
          TiO2         0.98          0.44
          P2O5         0.03          0.03
          MnO          0.19          0.04
          CO2          4.70          5.89
          S            0.05          0.05
          H2O+         2.95          0.78
          H2O-         0.07          0.02
          LOI          6.60          4.94
          TOTAL       99.28          0.78
          S.G.         3.02          0.06
```

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	4	-2.00	0.00
As	4	16.87	27.42
Au	4	-0.75	2.50
Ba	9	97.78	109.40
Co	9	48.11	10.82
Cr	9	283.00	363.31
Cu	9	62.44	31.38
Li	9	24.44	15.36
Ni	9	140.11	106.46
Pb	9	116.67	146.16
Sb	4	1.18	0.92
Zn	9	101.67	45.27
B	3	13.00	16.09
Be	9	0.67	1.41
Mo	9	-10.00	0.00
Sc	9	36.22	7.56
Sr	9	131.11	63.19
V	9	267.78	42.51
Y	9	7.11	6.41
Ga	4	19.25	4.99
Nb	9	23.44	7.58
Rb	4	9.25	5.91
Zr	9	30.11	21.32
Sn	4	2.75	0.96
Ce	9	64.44	1.67
La	9	67.22	5.65
Nd	9	95.00	2.50

SAGE
MAFIC VOLCANICS, AREA II

MAJOR OXIDE LISTING

	82RPS-0075	82RPS-0076	82RPS-0077	82RPS-0078	82RPS-0079	82RPS-0080
SiO2	59.00	46.70	49.20	45.70	50.20	49.00
Al2O3	16.90	12.80	15.40	15.10	16.30	15.70
Fe2O3	2.31	4.55	3.28	4.33	3.48	4.44
FeO	4.38	8.25	8.33	9.35	6.57	8.03
MgO	3.39	6.73	4.28	7.16	4.56	4.49
CaO	3.51	7.85	10.60	8.20	11.90	12.20
Na2O	4.92	2.14	0.52	1.74	2.02	1.27
K2O	0.76	00.00	0.02	0.01	0.07	0.25
TiO2	0.89	0.91	0.91	1.05	0.94	1.10
P2O5	0.09	0.02	0.02	0.03	0.02	0.03
MnO	0.10	0.18	0.20	0.18	0.16	0.22
CO2	0.64	5.10	3.14	1.33	0.64	0.41
S	0.01	0.01	0.01	0.35	0.12	0.17
H2O+	2.25	3.70	4.01	4.23	2.41	2.27
H2O-	0.08	0.12	0.09	0.09	0.04	0.05
LOI	2.60	8.10	6.10	4.40	2.30	1.70
TOTAL	99.23	99.06	100.01	98.85	99.43	99.63
S.G.	2.77	2.82	2.93	2.95	3.02	3.07

TRACE ELEMENT LISTING

	METHOD	82RPS-0075	82RPS-0076	82RPS-0077	82RPS-0078	82RPS-0079	82RPS-0080
Ba	AA	170	20	30	30	50	110
Co	AA	21	37	42	44	44	42
Cr	AA	42	209	225	203	237	210
Cu	AA	40	103	52	104	50	102
Li	AA	14	14	9	4	6	5
Ni	AA	29	58	118	91	127	94
Pb	AA	350	540	1770	154	640	845
Zn	AA	93	130	96	92	78	91
Be	ICP/OES	1	1	1	1	1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	13	35	40	40	40	45
Sr	ICP/OES	280	100	130	120	120	135
V	ICP/OES	95	275	280	280	295	290
Y	ICP/OES	15	16	19	22	21	24
Nb	XRF	11	16	16	35	14	15
Zr	XRF	70	21	25	21	12	11

```
          MAJOR OXIDE STATISTICS

          TOTAL NUMBER OF SAMPLES:            6


             MEAN   STD. DEVIATION
SiO2        49.97          4.73
Al2O3       15.37          1.41
Fe2O3        3.73          0.87
FeO          7.49          1.76
MgO          5.10          1.49
CaO          9.04          3.27
Na2O         2.10          1.50
K2O          0.18          0.30
TiO2         0.97          0.09
P2O5         0.04          0.03
MnO          0.17          0.04
CO2          1.88          1.87
S            0.11          0.14
H2O+         3.15          0.93
H2O-         0.08          0.03
LOI          4.20          2.50
TOTAL       99.37          0.41
S.G.         2.93          0.11
```

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ba	6	68.33	59.47
Co	6	38.33	8.87
Cr	6	187.67	72.44
Cu	6	75.17	30.77
Li	6	8.67	4.46
Ni	6	86.17	36.95
Pb	6	716.50	568.17
Zn	6	96.67	17.48
Be	6	1.00	0.00
Mo	6	-10.00	0.00
Sc	6	35.50	11.47
Sr	6	147.50	66.01
V	6	252.50	77.51
Y	6	19.50	3.51
Nb	6	17.83	8.61
Zr	6	26.67	21.93

SAGE
ALTERATION STUDY, MAGPIE MINE AREA, AREA II

MAJOR OXIDE LISTING

	83RPS-0058	83RPS-0059	83RPS-0060	83RPS-0061	83RPS-0062	83RPS-0063
SiO2	66.90	64.20	62.30	72.70	67.00	61.70
Al2O3	16.10	16.90	17.90	16.30	12.70	18.10
Fe2O3	2.14	2.43	1.88	00.00	0.67	0.78
FeO	1.09	2.11	3.20	1.24	1.02	1.96
MgO	0.77	1.49	0.77	0.78	0.76	0.69
CaO	3.54	4.64	3.76	0.58	5.89	4.50
Na2O	6.33	2.15	6.29	2.02	1.81	1.54
K2O	0.19	3.07	0.44	3.33	2.66	3.61
TiO2	0.53	0.51	0.87	0.52	0.38	0.54
P2O5	0.07	0.08	0.11	0.08	0.05	0.07
MnO	0.07	0.09	0.19	0.02	0.14	0.07
CO2	0.20	0.09	0.08	0.11	4.28	3.00
S	0.09	0.03	0.01	00.00	00.00	0.04
H2O+	0.85	1.19	1.21	1.68	1.30	2.12
H2O-	0.14	0.06	0.10	0.06	0.13	0.33
LOI	1.00	1.50	1.40	2.40	5.60	5.60
TOTAL	99.00	99.10	99.10	99.40	98.80	99.10
S.G.	2.71	2.83	2.77	2.71	2.72	2.75

TRACE ELEMENT LISTING

	METHOD	83RPS-0058	83RPS-0059	83RPS-0060	83RPS-0061	83RPS-0062	83RPS-0063
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	4 M	4 M	-1 M	-1 M	1 M	2 M
Au	AA	10 B	5 B	4 B	4 B	19 B	
Ba	AA	140	660	170	1000	400	380
Co	AA	13	10	6	-5	-5	10
Cr	AA	77	81	15	81	57	86
Cu	AA	36	19	7	6	6	30
Li	AA	10	35	10	13	22	10
Ni	AA	23	27	9	7	-5	30
Pb	AA	22	-10	-10	-10	-10	-10
Sb	AA	1.2M	1.2M	0.5M	1.1M	0.6M	0.6M
Zn	AA	46	48	46	20	36	52
Be	ICP/OES	1	1	2	2	1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	10	10	5	9	6	11
Sr	ICP/OES	460	270	215	125	85	165
V	ICP/OES	115	85	75	80	55	90
Y	ICP/OES	8	9	12	6	7	9
Ga	XRF	14	16	18	23	12	21
Nb	XRF	7	6	7	5	4	6
Zr	XRF	60	55	110	90	65	90
Sn	XRF	40	70	20	30	50	40

MAJOR OXIDE LISTING

	83RPS-0064	83RPS-0065	83RPS-0066	83RPS-0068	83RPS-0069	83RPS-0070
SiO2	59.80	62.90	66.30	67.40	63.20	62.20
Al2O3	11.20	16.00	17.30	15.20	15.50	15.10
Fe2O3	7.10	1.66	0.92	0.37	1.42	1.11
FeO	7.64	4.95	1.96	2.18	3.35	2.76
MgO	2.23	1.25	0.88	0.45	1.18	0.59
CaO	5.61	2.01	3.56	3.01	3.17	5.27
Na2O	0.29	4.52	1.87	7.35	3.19	5.14
K2O	0.50	1.36	2.03	0.08	2.44	1.39
TiO2	0.45	0.62	0.54	0.42	0.60	0.52
P2O5	0.04	0.09	0.10	0.16	0.09	0.26
MnO	0.67	0.18	0.06	0.11	0.21	0.26
CO2	0.25	1.49	1.65	2.01	2.35	3.83
S	0.12	0.01	0.01	00.00	0.02	00.00
H2O+	2.32	2.38	1.58	0.85	1.94	1.39
H2O-	0.08	0.14	0.20	0.07	0.11	0.08
LOI	1.80	3.30	4.00	2.70	4.40	5.10
TOTAL	98.30	99.60	99.00	99.70	98.80	99.90
S.G.	2.96	2.74	2.76	2.67	2.72	2.72

TRACE ELEMENT LISTING

	METHOD	83RPS-0064	83RPS-0065	83RPS-0066	83RPS-0068	83RPS-0069	83RPS-0070
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	2.5M	3 M	3.5M	2 M	1.5M	-1 M
Au	AA	11 B	50 B	3 B	60 B	6 B	-2 B
Ba	AA	100	270	290	50	800	230
Co	AA	13	9	9	-5	11	5
Cr	AA	27	81	8	-5	86	14
Cu	AA	14	7	22	5	12	6
Li	AA	25	12	26	14	10	9
Ni	AA	23	28	-5	-5	30	-5
Pb	AA	-10	18	18	-10	40	42
Sb	AA	1.2M	0.3M	2.6M	0.1M	0.2M	0.2M
Zn	AA	78	42	82	38	42	30
Be	ICP/OES	-1	1	-1	-1	2	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	12	9	6	4	9	7
Sr	ICP/OES	165	105	470	170	170	295
V	ICP/OES	70	75	55	35	80	45
Y	ICP/OES	8	6	10	8	8	9
Ga	XRF	14	18	20	14	14	15
Nb	XRF	6	6	3	3	6	4
Zr	XRF	45	110	80	85	105	95
Sn	XRF	50	80	50	-10	30	10

6

MAJOR OXIDE LISTING

	83RPS-0072	83RPS-0073	83RPS-0074	83RPS-0075	83RPS-0076	83RPS-0077
SiO2	70.10	63.40	67.20	70.80	68.20	69.70
Al2O3	16.70	15.60	15.70	15.60	14.70	12.10
Fe2O3	0.54	0.71	1.06	0.43	0.38	3.81
FeO	0.58	0.95	1.67	0.73	1.09	4.29
MgO	0.30	0.64	1.62	0.27	0.33	1.15
CaO	2.43	6.11	3.33	2.37	4.71	0.83
Na2O	4.49	5.35	5.14	5.52	4.21	4.40
K2O	2.06	1.13	1.03	1.48	1.70	0.34
TiO2	0.44	0.47	0.54	0.33	0.29	0.37
P2O5	0.03	0.11	0.08	0.09	0.07	0.08
MnO	0.04	0.07	0.06	0.05	0.10	0.24
CO2	0.95	3.59	0.43	1.26	2.87	0.56
S	00.00	0.02	00.00	0.01	00.00	00.00
H2O+	1.29	0.92	1.29	0.63	0.68	1.51
H2O-	0.11	0.06	0.06	0.05	0.06	0.11
LOI	2.20	4.30	1.80	2.10	3.80	1.80
TOTAL	100.00	99.30	99.20	99.60	99.40	99.50
S.G.	2.70	2.70	2.74	2.68	2.70	2.75

TRACE ELEMENT LISTING

	METHOD	83RPS-0072	83RPS-0073	83RPS-0074	83RPS-0075	83RPS-0076	83RPS-0077
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	1 M	-1 M	4 M	-1 M	2.5M	-1 M
Au	AA	10 B	5 B	2 B	3 B	-2 B	4710 B
Ba	AA	300	180	280	290	220	170
Co	AA	5	6	16	6	5	7
Cr	AA	-5	8	88	-5	-5	-5
Cu	AA	7	16	22	-5	-5	8
Li	AA	5	10	18	8	8	19
Ni	AA	-5	-5	33	-5	-5	-5
Pb	AA	-10	51	16	53	24	163
Sb	AA	0.3M	0.3M	0.2M	0.3M	0.2M	0.1M
Zn	AA	30	46	109	40	38	41
Be	ICP/OES	-1	-1	-1	-1	-1	2
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	4	5	9	3	3	4
Sr	ICP/OES	215	300	205	245	310	100
V	ICP/OES	45	50	85	18	16	25
Y	ICP/OES	8	9	7	10	9	7
Ga	XRF	16	13	16	17	16	13
Nb	XRF	4	5	6	3	4	4
Zr	XRF	100	90	60	100	85	80
Sn	XRF	20	10	10	20	20	20

MAJOR OXIDE LISTING

	83RPS-0078	83RPS-0079	83RPS-0080	83RPS-0081	83RPS-0082	83RPS-0083
SiO2	66.20	76.40	66.80	64.40	66.40	63.30
Al2O3	15.60	14.40	15.70	12.40	14.90	15.60
Fe2O3	2.00	0.25	0.52	1.22	0.72	0.54
FeO	2.11	0.44	1.09	5.02	2.33	3.56
MgO	0.86	0.20	0.58	1.23	0.87	1.58
CaO	2.96	0.31	4.64	4.75	4.68	4.53
Na2O	1.95	5.90	5.58	3.32	2.69	4.52
K2O	3.23	1.08	0.72	0.86	1.32	0.56
TiO2	0.54	0.32	0.52	0.71	0.53	0.60
P2O5	0.03	0.08	0.08	0.10	0.08	0.09
MnO	0.14	0.02	0.07	0.19	0.10	0.07
CO2	1.32	0.12	2.10	3.60	3.37	3.09
S	00.00	0.01	0.02	0.13	00.00	00.00
H2O+	2.03	0.47	0.81	2.00	1.86	1.87
H2O-	0.12	0.08	0.11	0.10	0.12	0.08
LOI	3.00	1.00	2.90	4.80	4.80	4.70
TOTAL	99.10	100.10	99.30	100.00	100.00	100.00
S.G.	2.76	2.65	2.63	2.74	2.74	2.71

TRACE ELEMENT LISTING

	METHOD	83RPS-0078	83RPS-0079	83RPS-0080	83RPS-0081	83RPS-0082	83RPS-0083
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	1 M	7 M	2 M	6.5M	-1 M	1 M
Au	AA	-2 B	2 B	7 B	-2 B	4 B	-2 B
Ba	AA	520	280	160	220	280	200
Co	AA	11	-5	12	12	10	17
Cr	AA	12	-5	79	20	81	87
Cu	AA	9	-5	19	26	42	14
Li	AA	14	6	8	18	18	24
Ni	AA	11	-5	14	14	20	36
Pb	AA	100	23	56	35	42	21
Sb	AA	0.4M	0.1M	0.3M	0.2M		0.1M
Zn	AA	37	20	34	75	44	76
Be	ICP/OES	1	1	-1	-1	1	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	7	1	7	11	10	10
Sr	ICP/OES	200	155	410	200	290	225
V	ICP/OES	60	14	75	85	75	75
Y	ICP/OES	7	6	8	14	8	7
Ga	XRF	16	14	15	14	18	19
Nb	XRF	6	2	5	6	4	4
Zr	XRF	80	90	80	125	105	110
Sn	XRF	20	-10	-10	20	10	20

MAJOR OXIDE LISTING

	83RPS-0084	83RPS-0085	83RPS-0086	83RPS-0087	83RPS-0088	83RPS-0090
SiO2	64.10	77.10	62.10	55.30	73.60	70.00
Al2O3	15.50	15.20	15.80	13.60	13.40	14.40
Fe2O3	1.37	00.00	1.50	3.02	00.00	0.12
FeO	2.69	0.87	4.51	6.55	0.51	0.87
MgO	1.95	0.51	1.63	1.85	0.10	0.12
CaO	6.04	1.01	2.94	4.64	3.26	4.12
Na2O	2.48	1.43	2.15	3.85	5.02	4.55
K2O	1.04	1.40	2.68	0.59	1.18	1.49
TiO2	0.55	0.56	0.56	0.49	0.65	0.83
P2O5	0.08	0.05	0.07	0.06	0.09	0.12
MnO	0.07	0.01	0.17	0.35	0.08	0.13
CO2	1.47	0.34	1.91	3.38	1.81	2.32
S	00.00	00.00	0.28	1.51	0.02	0.01
H2O+	1.77	1.64	2.55	2.27	0.29	0.59
H2O-	0.09	0.13	0.12	0.13	0.06	0.05
LOI	3.30	2.10	4.20	4.70	2.10	2.70
TOTAL	99.20	100.20	99.00	97.60	100.00	99.70
S.G.	2.79	2.73	2.76	2.79	2.68	2.70

TRACE ELEMENT LISTING

	METHOD	83RPS-0084	83RPS-0085	83RPS-0086	83RPS-0087	83RPS-0088	83RPS-0090
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	1.5M	-1 M	6.5M	12 M	-1 M	-1 M
Au	AA	-2 B	2 B	6 B	9 B	-2 B	-2 B
Ba	AA	180	260	530	180	320	320
Co	AA	21	6	22	36	-5	-5
Cr	AA	88	81	20	28	17	15
Cu	AA	27	8	22	44	10	18
Li	AA	18	27	14	18	-3	4
Ni	AA	40	9	22	28	-5	-5
Pb	AA	22	-10	-10	-10	-10	36
Sb	AA	0.4M		0.3M	0.3M	0.2M	0.2M
Zn	AA	82	30	49	64	9	12
Be	ICP/OES	-1	2	1	-1	-1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	11	7	9	11	3	6
Sr	ICP/OES	275	380	140	215	355	470
V	ICP/OES	80	70	80	75	50	75
Y	ICP/OES	9	6	6	7	8	10
Ga	XRF	17	21	18	17	16	15
Nb	XRF	7	5	6	6	4	6
Zr	XRF	35	110	65	55	100	105
Sn	XRF	20	10	60	40	10	20

MAJOR OXIDE LISTING

	83RPS-0091	83RPS-0092	83RPS-0093	83RPS-0094	83RPS-0095	83RPS-0096
SiO2	58.00	57.00	62.60	73.00	57.50	63.90
Al2O3	18.20	15.80	16.10	13.90	17.40	13.20
Fe2O3	2.14	1.40	1.17	0.14	3.18	1.14
FeO	6.55	6.62	3.85	0.65	5.45	3.56
MgO	1.59	2.25	2.44	0.22	2.62	0.96
CaO	1.13	5.80	4.74	3.28	4.94	5.18
Na2O	5.07	3.33	3.93	3.84	3.60	3.28
K2O	1.65	0.70	0.72	1.70	0.33	1.30
TiO2	0.93	0.78	0.57	0.48	0.63	0.49
P2O5	0.13	0.12	0.06	0.05	0.09	0.07
MnO	0.34	0.28	0.13	0.05	0.25	0.26
CO2	0.26	2.48	1.56	1.42	0.77	3.98
S	0.01	0.02	0.01	0.01	0.01	0.14
H2O+	2.75	2.71	1.68	0.61	3.11	1.58
H2O-	0.09	0.05	0.15	0.05	0.11	0.08
LOI	2.80	4.70	3.60	2.40	3.10	4.70
TOTAL	98.80	99.30	99.70	99.40	100.00	99.10
S.G.	2.77	2.80	2.76	2.70	2.82	2.73

TRACE ELEMENT LISTING

	METHOD	83RPS-0091	83RPS-0092	83RPS-0093	83RPS-0094	83RPS-0095	83RPS-0096
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	1 M	-1 M	-1 M	-1 M	1 M	1.5M
Au	AA	-2 B	-2 B	-2 B	-2 B	-2 B	-2 B
Ba	AA	800	180	160	360	130	330
Co	AA	13	19	14	-5	17	10
Cr	AA	23	28	91	5	22	15
Cu	AA	6	11	6	6	16	16
Li	AA	20	20	24	6	25	10
Ni	AA	16	15	19	-5	16	6
Pb	AA	-10	-10	48	36	116	31
Sb	AA	0.1M	0.2M	0.2M	0.1M	0.5M	0.2M
Zn	AA	70	115	84	14	149	36
Be	ICP/OES	1	1	-1	-1	-1	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	11	13	11	4	9	8
Sr	ICP/OES	215	275	305	210	410	210
V	ICP/OES	85	95	75	35	80	50
Y	ICP/OES	14	8	5	6	6	7
Ga	XRF	19	15	17	16	10	15
Nb	XRF	7	7	6	4	6	4
Zr	XRF	105	35	70	65	45	60
Sn	XRF	20	20	20	10	10	20

MAJOR OXIDE LISTING

	83RPS-0098	83RPS-0099	83RPS-0100	83RPS-0101	83RPS-0103	83RPS-0104
SiO2	58.10	68.70	67.70	71.10	68.10	63.60
Al2O3	17.10	14.40	15.30	15.60	15.70	15.50
Fe2O3	1.20	1.05	0.25	0.38	1.16	1.20
FeO	3.56	3.27	0.73	1.24	2.40	2.84
MgO	1.21	0.52	0.24	0.28	2.81	1.17
CaO	5.57	2.92	4.80	2.12	1.26	5.50
Na2O	3.04	3.86	4.40	4.63	5.19	3.75
K2O	2.19	1.27	1.80	1.01	0.26	0.74
TiO2	0.52	0.35	0.34	0.35	0.51	0.56
P2O5	0.07	0.09	0.04	0.08	0.12	0.09
MnO	0.17	0.17	0.11	0.09	0.09	0.09
CO2	4.36	1.25	3.23	1.19	0.13	2.74
S	0.21	0.01	00.00	00.00	00.00	00.00
H2O+	2.19	0.99	0.56	1.10	2.18	1.47
H2O-	0.10	0.13	0.06	0.10	0.14	0.11
LOI	6.20	2.70	4.20	2.70	1.90	4.10
TOTAL	99.60	99.00	99.60	99.30	100.00	99.40
S.G.	2.74	2.71	2.68	2.70	2.69	2.76

TRACE ELEMENT LISTING

	METHOD	83RPS-0098	83RPS-0099	83RPS-0100	83RPS-0101	83RPS-0103	83RPS-0104
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	5 M	-1 M	-1 M	-1 M	-1 M	1 M
Au	AA	3 B	-2 B	-2 B	-2 B	7 B	2 B
Ba	AA	310	330	310	340	120	200
Co	AA	10	5	-5	-5	8	12
Cr	AA	17	-5	-5	-5	-5	81
Cu	AA	30	5	-5	-5	18	19
Li	AA	17	12	6	12	22	16
Ni	AA	9	-5	-5	-5	5	32
Pb	AA	48	23	24	46	71	19
Sb	AA	0.6M	0.2M	0.2M	0.4M	0.1M	0.2M
Zn	AA	68	79	40	41	49	108
Be	ICP/OES	1	-1	-1	-1	2	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	6	4	4	2	7	11
Sr	ICP/OES	395	255	260	325	455	240
V	ICP/OES	50	21	22	15	55	75
Y	ICP/OES	5	8	8	8	4	9
Ga	XRF	17	15	19	17	16	18
Nb	XRF	3	4	4	3	4	4
Zr	XRF	45	85	100	105	95	80
Sn	XRF	20	10	50	10	-10	10

MAJOR OXIDE LISTING

	83RPS-0105	83RPS-0106	83RPS-0107	83RPS-0108	83RPS-0109	83RPS-0111
SiO2	70.70	69.30	67.70	69.20	69.30	70.40
Al2O3	16.70	17.40	16.60	14.40	14.80	16.10
Fe2O3	0.50	0.75	0.96	0.89	0.82	1.09
FeO	0.95	0.80	1.89	0.87	0.80	1.46
MgO	0.41	0.29	0.52	0.54	0.38	0.36
CaO	0.43	2.74	3.79	3.15	2.46	0.93
Na2O	4.80	4.75	1.32	2.17	0.83	3.31
K2O	2.66	0.78	1.42	3.79	6.20	3.22
TiO2	0.51	0.47	0.54	0.28	0.33	0.40
P2O5	0.06	0.04	0.08	0.05	0.08	0.08
MnO	0.03	0.04	0.11	0.05	0.04	0.03
CO2	0.34	0.72	2.16	2.48	1.92	0.63
S	0.01	0.01	00.00	00.00	00.00	00.00
H2O+	0.89	1.61	2.45	1.76	1.65	1.60
H2O-	0.12	0.05	0.12	0.10	0.15	0.06
LOI	1.70	2.30	5.00	4.40	3.60	2.30
TOTAL	99.10	99.80	99.70	99.70	99.80	99.70
S.G.	2.65	2.72	2.76	2.73	2.70	2.72

TRACE ELEMENT LISTING

	METHOD	83RPS-0105	83RPS-0106	83RPS-0107	83RPS-0108	83RPS-0109	83RPS-0111
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	-1 M	1.5M	-1 M	-1 M	-1 M	-1 M
Au	AA	5 B	2 B	-2 B	-2 B	-2 B	-2 B
Ba	AA	730	190	250	620	710	630
Co	AA	-5	-5	8	-5	-5	-5
Cr	AA	6	-5	9	-5	-5	-5
Cu	AA	6	54	18	-5	-5	-5
Li	AA	7	10	28	24	18	14
Ni	AA	-5	-5	11	-5	-5	-5
Pb	AA	34	125	62	62	139	37
Sb	AA		0.3M	0.4M		0.2M	0.2M
Zn	AA	32	38	50	42	34	56
Be	ICP/OES	-1	1	-1	1	-1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	5	5	8	2	3	3
Sr	ICP/OES	90	350	320	165	100	140
V	ICP/OES	55	45	55	7	16	17
Y	ICP/OES	6	6	8	8	8	8
Ga	XRF	19	18	18	19	17	23
Nb	XRF	5	3	4	4	4	4
Zr	XRF	110	95	60	110	130	140
Sn	XRF	-10	10	20	10	-10	20

MAJOR OXIDE LISTING

	83RPS-0112	83RPS-0113	83RPS-0114	83RPS-0115	83RPS-0057
SiO2	69.40	67.50	72.30	65.20	64.40
Al2O3	15.70	15.70	14.00	14.70	15.80
Fe2O3	1.08	1.74	1.13	1.36	1.36
FeO	0.95	0.95	0.80	2.55	3.27
MgO	0.17	0.38	0.56	1.31	2.64
CaO	3.14	2.24	1.80	2.81	2.34
Na2O	3.80	1.01	3.42	1.87	5.78
K2O	2.65	6.90	2.72	5.30	0.40
TiO2	0.40	0.37	0.37	0.53	0.56
P2O5	0.09	0.09	0.06	0.06	0.07
MnO	0.05	0.04	0.04	0.07	0.12
CO2	1.38	1.42	0.96	1.97	0.13
S	00.00	00.00	00.00	00.00	0.03
H2O+	1.01	1.27	1.07	1.87	1.77
H2O-	0.11	0.08	0.10	0.17	0.06
LOI	2.70	2.20	2.20	3.60	1.60
TOTAL	99.90	99.70	99.30	99.80	98.70
S.G.	2.73	2.71	2.71	2.74	2.73

TRACE ELEMENT LISTING

	METHOD	83RPS-0112	83RPS-0113	83RPS-0114	83RPS-0115	83RPS-0057
Ag	AA	-2	-2	-2	-2	-2
As	AA	-1 M	-1 M	-1 M	-1 M	150
Au	AA	-2 B	-2 B	-2 B	-2 B	401 3
Ba	AA	420	810	460	740	
Bi	AA					8
Co	AA	-5	6	-5	11	840
Cr	AA	-5	-5	-5	44	600
Cu	AA	-5	-5	-5	37	2 8
Li	AA	11	17	14	24	32
Ni	AA	-5	-5	-5	21	-100
Pb	AA	43	69	78	53	
Sb	AA	0.2M	0.2M	0.1M	0.1M	5000
Zn	AA	55	64	50	60	77
Be	ICP/OES	-1	-1	-1	-1	
Co	ICP/OES					-100 1
Cu	ICP/OES					3 0
Mo	ICP/OES	-10	-10	-10	-10	7
Ni	ICP/OES					90
Sc	ICP/OES	3	3	2	8	1002 3
Sr	ICP/OES	270	135	165	80	7 5
V	ICP/OES	15	17	9	70	7
W	ICP/OES					700
Y	ICP/OES	10	10	9	6	
Ga	XRF	19	18	14	17	
Nb	XRF	4	4	3	5	
Sr	XRF					18

Zr	XRF	85	110	105	85
Sn	XRF	10	10	10	10

```
          MAJOR OXIDE STATISTICS

          TOTAL NUMBER OF SAMPLES:          53


            MEAN   STD. DEVIATION
SiO2       66.35         4.78
Al2O3      15.38         1.48
Fe2O3       1.22         1.15
FeO         2.44         1.83
MgO         0.97         0.73
CaO         3.44         1.60
Na2O        3.70         1.60
K2O         1.79         1.45
TiO2        0.51         0.14
P2O5        0.08         0.04
MnO         0.13         0.11
CO2         1.72         1.25
S           0.05         0.21
H2O+        1.53         0.65
H2O-        0.10         0.05
LOI         3.20         1.31
TOTAL      99.42         0.49
S.G.        2.73         0.05
```

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	53	-2.00	0.00
As	53	3.84	20.64
Au	52	101.96	653.97
Ba	52	355.96	222.14
Bi	1	8.00	0.00
Co	53	22.09	114.87
Cr	53	39.49	86.22
Cu	53	12.40	14.08
Li	53	15.45	7.75
Ni	53	6.30	20.60
Pb	52	34.73	40.70
Sb	49	102.42	714.23
Zn	53	52.96	27.19
Be	52	-0.04	1.17
Co	1	-100.00	0.00
Cu	1	3.00	0.00
Mo	53	-9.68	2.34
Ni	1	90.00	0.00
Sc	53	25.53	136.75
Sr	53	240.79	110.98
V	53	54.42	27.97
W	1	700.00	0.00
Y	52	7.94	1.96
Ga	52	16.65	2.58
Nb	52	4.73	1.30
Sr	1	18.00	0.00
Zr	52	86.25	24.37
Sn	52	20.00	19.70

SAGE
METASEDIMENTS, AREA II

MAJOR OXIDE LISTING

	82RPS-0122	82RPS-0123	82RPS-0124	82RPS-0125
SiO2	64.40	60.00	63.70	67.10
Al2O3	16.20	13.40	13.60	13.30
Fe2O3	0.89	1.13	0.92	0.88
FeO	3.29	5.55	3.36	3.07
MgO	2.40	4.35	3.26	2.49
CaO	2.42	3.54	2.91	2.44
Na2O	3.51	2.47	4.07	3.18
K2O	1.61	0.93	1.11	1.53
TiO2	0.56	0.66	0.52	0.48
P2O5	0.03	0.04	0.03	0.02
MnO	0.05	0.08	0.07	0.06
CO2	2.27	5.32	4.44	3.71
S	0.05	0.12	0.10	0.22
H2O+	2.18	2.43	1.67	1.50
H2O-	0.06	0.02	0.03	0.05
LOI	3.70	7.10	5.60	4.80
TOTAL	99.92	100.04	99.79	100.03
S.G.	2.72	2.76	2.71	2.72

TRACE ELEMENT LISTING

	METHOD	82RPS-0122	82RPS-0123	82RPS-0124	82RPS-0125
Ba	AA	410	270	430	390
Co	AA	16	19	13	12
Cr	AA	141	302	198	179
Cu	AA	34	35	40	32
Li	AA	22	34	21	16
Ni	AA	63	85	76	55
Pb	AA	1400	560	710	260
Zn	AA	67	140	73	59
Be	ICP/OES	2	1	1	1
Mo	ICP/OES	-10	-10	-10	-10
Sc	ICP/OES	13	18	13	11
Sr	ICP/OES	315	270	270	230
V	ICP/OES	95	115	85	75
Y	ICP/OES	3	3	3	2
Nb	XRF	9	11	9	9
Zr	XRF	80	70	60	65

```
          MAJOR OXIDE STATISTICS

          TOTAL NUMBER OF SAMPLES:          4


             MEAN   STD. DEVIATION
SiO2        63.80        2.93
Al2O3       14.12        1.39
Fe2O3        0.96        0.12
FeO          3.82        1.16
MgO          3.12        0.90
CaO          2.83        0.53
Na2O         3.31        0.67
K2O          1.30        0.33
TiO2         0.56        0.08
P2O5         0.03        0.01
MnO          0.06        0.01
CO2          3.94        1.29
S            0.12        0.07
H2O+         1.95        0.43
H2O-         0.04        0.02
LOI          5.30        1.43
TOTAL       99.94        0.12
S.G.         2.73        0.02
```

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ba	4	375.00	71.88
Co	4	15.00	3.16
Cr	4	205.00	68.87
Cu	4	35.25	3.40
Li	4	23.25	7.63
Ni	4	69.75	13.35
Pb	4	732.50	482.73
Zn	4	84.75	37.28
Be	4	1.25	0.50
Mo	4	-10.00	0.00
Sc	4	13.75	2.99
Sr	4	271.25	34.73
V	4	92.50	17.08
Y	4	2.75	0.50
Nb	4	9.50	1.00
Zr	4	68.75	8.54

SAGE
MISCELLANEOUS ROCKS, AREA II

MAJOR OXIDE LISTING

	81RPS-0179	81RPS-0185	82RPS-0115	82RPS-0116	82RPS-0117	82RPS-0119
SiO2	57.20	43.70	64.40	76.60	44.00	17.30
Al2O3	11.50	12.40	13.00	14.20	13.00	0.44
Fe2O3	1.89	2.46	7.08	0.37	3.72	0.09
FeO	8.11	6.79	3.87	0.66	11.60	2.63
MgO	2.65	5.48	0.23	0.13	5.01	15.50
CaO	5.74	9.59	2.22	0.58	7.62	23.80
Na2O	0.52	0.50	4.83	3.76	2.79	00.00
K2O	0.44	0.65	0.07	1.74	00.00	00.00
TiO2	1.03	0.38	0.76	0.05	1.64	00.00
P2O5	0.09	0.05	0.10	0.01	0.04	00.00
MnO	0.39	0.17	0.17	0.04	0.20	0.91
CO2	8.69	14.50	1.60	0.49	6.16	39.00
S	0.02	0.40	0.01	0.03	0.13	0.01
H2O+	2.23	2.26	1.27	0.79	3.36	0.15
H2O-	0.09	0.14	0.03	0.03	0.06	0.05
LOI	9.50	15.90	2.90	1.50	8.40	37.90
TOTAL	100.59	99.47	99.64	99.48	99.33	99.88
S.G.	2.66	2.90	2.77	2.68	2.84	2.66

TRACE ELEMENT LISTING

	METHOD	81RPS-0179	81RPS-0185	82RPS-0115	82RPS-0116	82RPS-0117	82RPS-0119
Ba	AA	180	240	100	430	40	80
Co	AA	11	55	8	-5	39	-5
Cr	AA	10	208	-5	-5	95	-5
Cu	AA	60	42	8	6	57	8
Li	AA	22	9	24	5	13	3
Ni	AA	7	44	-5	-5	44	-5
Pb	AA	29	-10	33	107	96	740
Zn	AA	210	84	67	54	140	14
Be	ICP/OES	1	1	1	1	1	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	10	25	17	2	30	3
Sr	ICP/OES	140	120	120	40	100	30
V	ICP/OES	100	170	10	-1	340	2
Y	ICP/OES	4	1	17	7	13	-1
Nb	XRF	1	6	5	6	19	11
Rb	XRF	20	20	20	20	20	20
Zr	XRF	95	4	220	45	30	-1

MAJOR OXIDE LISTING

	82RPS-0176	82RPS-0177	82RPS-0178	82RPS-0159	82RPS-0160	82RPS-0161
SiO2	37.50	49.10	45.30	46.20	44.30	45.70
Al2O3	15.20	20.40	12.80	12.90	11.90	13.90
Fe2O3	3.09	1.75	1.61	5.74	2.95	1.97
FeO	7.16	14.20	11.20	7.60	12.20	6.72
MgO	2.88	3.59	6.14	4.56	5.62	6.96
CaO	18.50	0.62	5.94	12.80	8.40	8.77
Na2O	0.88	00.00	2.57	0.41	1.07	2.86
K2O	0.02	0.03	00.00	0.19	0.38	00.00
TiO2	1.13	2.73	1.51	1.00	1.50	0.86
P2O5	0.04	0.14	0.06	0.03	0.08	0.04
MnO	0.41	0.41	0.22	0.32	0.28	0.22
CO2	9.12	0.29	8.19	4.75	7.13	7.88
S	0.17	0.01	0.08	0.72	0.03	0.06
H2O+	2.36	4.99	3.14	3.50	3.98	3.81
H2O-	0.04	0.06	0.06	0.06	0.04	0.09
LOI	10.70	3.90	10.20	6.90	9.80	10.10
TOTAL	98.50	98.32	98.82	100.78	99.86	99.84
S.G.	2.96	3.02	2.83	00.00	00.00	00.00

TRACE ELEMENT LISTING

	METHOD	82RPS-0176	82RPS-0177	82RPS-0178	82RPS-0159	82RPS-0160	82RPS-0161
Ba	AA	80	30	30	30	130	40
Co	AA	38	24	43	43	28	18
Cr	AA	196	119	104	104	56	215
Cu	AA	58	6	74	74	128	124
Li	AA	10	40	64	64	26	48
Ni	AA	91	81	61	61	23	85
Pb	AA	255	505	114	114	-10	-10
Zn	AA	102	220	150	150	132	100
Be	ICP/OES	1	1	1	1	1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	25	30	25	25	40	35
Sr	ICP/OES	150	30	80	230	55	30
V	ICP/OES	340	320	315	385	465	275
Y	ICP/OES	17	-2	2	15	11	-2
Cs	XRF	-10	-10	-10	-10	-10	-10
Nb	XRF	20	19	18	16	17	11
Rb	XRF	20	-10	-10	-10	-10	-10
Zr	XRF	-1	60	35	30	70	22
Ta	XRF	-30	-30	-30	-30	-30	-30
Th	ICP-MS	-10	-10	-10	-10	-10	-10
Ce	ICP-MS	-35	-35	-35	-35	-35	-35
Nd	ICP-MS	65	35	50	50	50	50

MAJOR OXIDE LISTING

	82RPS-0162	82RPS-0163	82RPS-0164	82RPS-0165	82RPS-0166	82RPS-0167
SiO_2	48.70	41.60	60.10	66.40	80.60	76.80
Al_2O_3	24.60	6.69	14.80	17.40	14.50	13.90
Fe_2O_3	6.64	5.86	3.56	1.17	0.99	0.36
FeO	7.08	11.70	2.56	0.58	0.88	0.21
MgO	1.55	20.50	5.49	0.66	0.23	0.18
CaO	0.34	1.69	0.15	1.06	0.04	0.09
Na_2O	1.01	0.61	9.49	7.04	0.30	1.80
K_2O	0.75	0.09	0.18	2.20	1.02	4.59
TiO_2	1.87	1.92	0.59	0.30	0.34	0.19
P_2O_5	0.06	0.04	0.04	0.01	0.04	0.03
MnO	0.17	0.16	0.04	0.04	0.06	0.01
CO_2	1.11	1.00	0.58	1.65	0.25	0.35
S	0.08	0.09	0.01	0.18	0.02	0.01
H_2O+	4.68	6.47	1.87	0.76	1.10	0.70
H_2O-	0.22	0.26	0.58	0.19	0.10	0.08
LOI	4.20	7.10	2.40	2.40	1.30	1.10
TOTAL	98.86	98.68	100.04	99.64	100.47	99.30
S.G.	00.00	0.50	00.00	00.00	00.00	00.00

TRACE ELEMENT LISTING

	METHOD	82RPS-0162	82RPS-0163	82RPS-0164	82RPS-0165	82RPS-0166	82RPS-0167
Ba	AA	520	30	30	1260	120	710
Co	AA	88	91	24	55	37	78
Cr	AA	342	1610	19	5	-5	7
Cu	AA	118	245	13	9	8	14
Li	AA	34	52	8	24	13	22
Ni	AA	66	1000	16	-5	14	-5
Pb	AA	-10	-10	-10	-10	-10	12
Zn	AA	130	130	75	66	32	20
Be	ICP/OES	2	2	1	2	-1	-1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	60	13	8	2	7	5
Sr	ICP/OES	40	15	15	355	40	14
V	ICP/OES	525	335	110	24	30	10
Y	ICP/OES	-2	-2	-2	-2	3	15
Cs	XRF	-10	-10	-10	-10	-10	-10
Nb	XRF	18	30	8	3	5	6
Rb	XRF	-10	-10	-10	-10	-10	-10
Zr	XRF	60	100	110	125	135	185
Ta	XRF	-30	-30	-30	-30	-30	-30
Th	ICP-MS	-10	-10	-10	-10	-10	-10
Ce	ICP-MS	-35	-35	-35	-35	-35	-35
Nd	ICP-MS	50	50	50	50	50	50

MAJOR OXIDE LISTING

	82RPS-0168	82RPS-0169	82RPS-0170	82RPS-0158	83RPS-0190	83RPS-0191
SiO2	75.00	73.40	73.00	59.80	70.50	61.60
Al2O3	13.40	14.10	16.40	16.10	14.40	14.70
Fe2O3	1.50	3.11	0.27	1.87	1.72	0.71
FeO	0.15	0.37	0.15	7.23	2.04	4.00
MgO	0.05	0.31	0.16	3.37	0.72	1.96
CaO	0.88	0.08	0.52	0.87	2.69	4.86
Na2O	2.61	0.66	3.18	0.34	3.63	2.50
K2O	2.34	4.03	3.24	3.59	1.52	1.91
TiO2	0.30	0.43	0.39	1.18	0.28	0.67
P2O5	0.05	0.05	0.05	0.05	00.00	0.05
MnO	0.08	0.09	0.01	0.10	0.17	0.06
CO2	0.95	0.89	0.56	0.43	0.07	3.94
S	0.01	0.02	0.01	0.03	0.01	00.00
H2O+	0.78	1.34	0.73	3.85	0.87	2.28
H2O-	0.18	0.36	0.28	0.07	0.06	0.04
LOI	2.00	2.40	1.60	3.70	1.40	6.20
TOTAL	98.28	99.24	98.95	98.88	98.70	99.30
S.G.	00.00	00.00	00.00	00.00	2.76	2.74

TRACE ELEMENT LISTING

	METHOD	82RPS-0168	82RPS-0169	82RPS-0170	82RPS-0158	83RPS-0190	83RPS-0191
Ag	AA					-2	-2
As	AA					-10	2.5
Au	AA					-2 B	-2 B
Ba	AA	1090	360	1240	610	370	270
Co	AA	31	31	34	34	-5	16
Cr	AA	-5	24	-5	224	-5	49
Cu	AA	-5	24	34	93	-5	42
Li	AA	6	37	9	18	16	24
Ni	AA	-5	6	8	40	-5	24
Pb	AA	-10	-10	-10	-10	-10	-10
Sb	AA					0.2	-1
Zn	AA	22	41	19	95	32	82
B	ICP/OES					12	18
Be	ICP/OES	1	1	1	1	1	1
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Sc	ICP/OES	6	9	4	25	2	12
Sr	ICP/OES	35	14	40	17	270	125
V	ICP/OES	30	70	55	360	16	70
Y	ICP/OES	5	8	5	14	7	8
Cs	XRF	-10	-10	-10	-10	-10	-10
Ga	XRF					12	17
Nb	XRF	4	6	5	13	7	11
Rb	XRF	-10	-10	-10	-10	63	48
Zr	XRF	120	135	145	40	110	120
Ta	XRF	-30	-30	-30	-30	-30	-30
Sn	XRF					0.1	0.2

Th	ICP-MS	-10	-10	-10	-10	-10	-10
Ce	ICP-MS	-35	-35	-35	-35	60	60
La	ICP-MS					25	35
Nd	ICP-MS	50	50	50	50	50	65

MAJOR OXIDE LISTING

	83RPS-0192	83RPS-0193	83RPS-0194	83RPS-0195	86RPS-0091	83RPS-0213
SiO2	46.80	69.70	60.50	52.50	48.30	45.50
Al2O3	15.80	15.20	16.30	15.10	13.60	12.60
Fe2O3	2.57	0.81	1.50	2.76	5.71	0.93
FeO	8.15	1.86	5.02	6.40	6.74	9.67
MgO	8.14	1.39	2.77	6.07	7.93	3.80
CaO	11.30	1.70	2.98	9.07	11.50	8.78
Na2O	0.95	5.51	6.33	2.50	1.05	1.58
K2O	00.00	1.23	0.02	0.17	00.00	0.52
TiO2	0.76	0.41	0.83	1.29	0.78	1.35
P2O5	0.01	0.04	0.03	0.11	0.02	0.03
MnO	0.17	0.05	0.08	0.12	0.19	0.16
CO2	0.66	0.50	0.10	0.28	0.19	13.20
S	0.11	00.00	0.02	0.01	00.00	00.00
H2O+	3.02	1.05	1.63	2.52	2.37	2.24
H2O-	0.04	0.05	0.05	0.07	0.07	0.71
LOI	3.90	1.70	1.80	3.00	2.80	14.20
TOTAL	98.50	99.50	98.20	99.00	98.50	100.40
S.G.	3.03	2.70	2.76	2.95	3.06	3.04

TRACE ELEMENT LISTING

	METHOD	83RPS-0192	83RPS-0193	83RPS-0194	83RPS-0195	86RPS-0091	83RPS-0213
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	-10	1.5	-10	14	4.5	26
Au	AA	5 B	-2 B	-2 B	-2 B	-2 B	-2 B
Ba	AA	30	180	30	90		150
Co	AA	52	7	23	37	45	33
Cr	AA	224	-5	47	295	172	60
Cu	AA	108	10	44	62	24	16
Li	AA	4	14	8	14		30
Ni	AA	169	-5	44	138	81	35
Pb	AA	24	40	16	-10	-10	82
Sb	AA	0.9	0.2	0.2	0.3	0.7	1.3
Zn	AA	92	133	91	107	68	98
B	ICP/OES	-5	21	5	-5	8	104
Be	ICP/OES	1	1	1	1	1	1
Co	ICP/OES					55	
Cu	ICP/OES					24	
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Ni	ICP/OES					100	
Sc	ICP/OES	25	4	20	25	45	40
Sr	ICP/OES	95	295	105	400	170	115
V	ICP/OES	205	14	140	135	260	270
Y	ICP/OES	8	10	10	14	18	7
Zn	ICP/OES					80	
Cs	XRF	-10	-10	-10	-10		-10
Ga	XRF	16	13	13	25	19	16
Nb	XRF	23	8	19	25	6	30

Rb	XRF	7	24	8	7	-5	21
Zr	XRF	25	140	50	35		55
Ta	XRF	-30	-30	-30	-30		-30
Sn	XRF	0.2	0.1	0.2	0.3		0.3
Sn	AA					4.3	4.3

Th	ICP-MS	-10	-10	-10	-10		-10
Ce	ICP-MS	45	65	55	75	-35	55
La	ICP-MS	50	25	40	55	-35	55
Nd	ICP-MS	80	50	55	105		90

```
          MAJOR OXIDE STATISTICS

          TOTAL NUMBER OF SAMPLES:          30


             MEAN   STD. DEVIATION
SiO2        56.07        14.67
Al2O3       14.04         3.93
Fe2O3        2.49         1.96
FeO          5.58         4.18
MgO          4.13         4.58
CaO          5.44         5.94
Na2O         2.38         2.32
K2O          1.03         1.34
TiO2         0.88         0.64
P2O5         0.05         0.03
MnO          0.18         0.18
CO2          4.48         7.72
S            0.08         0.15
H2O+         2.34         1.51
H2O-         0.14         0.16
LOI          6.36         7.23
TOTAL       99.30         0.72
S.G.         1.63         1.42
```

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	8	-2.00	0.00
As	8	2.31	12.86
Au	8	-1.12	2.47
Ba	29	293.10	363.98
Co	30	33.60	24.28
Cr	30	138.17	295.87
Cu	30	49.97	54.15
Li	29	22.79	17.23
Ni	30	69.93	181.17
Pb	30	66.90	165.35
Sb	8	0.35	0.68
Zn	30	91.87	52.85
B	8	19.75	35.34
Be	30	0.90	0.71
Co	1	55.00	0.00
Cu	1	24.00	0.00
Mo	30	-10.00	0.00
Ni	1	100.00	0.00
Sc	30	19.30	14.93
Sr	30	109.50	104.84
V	30	179.33	156.77
Y	30	6.87	6.60
Zn	1	80.00	0.00
Cs	23	-10.00	0.00
Ga	8	16.37	4.21
Nb	30	12.53	8.11
Rb	30	5.43	19.38
Zr	29	79.28	57.23
Ta	23	-30.00	0.00
Sn	7	0.20	0.08
Sn	2	4.30	0.00
Th	23	-10.00	0.00
Ce	24	-7.50	44.04
La	8	31.25	29.37
Nd	23	56.30	15.54

```
 87RPS-0002482947208453611                TROUPE LAKE                          1
          87RPS-0002MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0002             126                           015 002 065007 05     2664
T87RPS-0002  -2   -1   -2B 850         6   11    9        -5   12 -0.1   39    1
T87RPS-0002 5.9    3    6    8  -10    9    3  440   28         7   38         2
T87RPS-0002       25       187            193                                  3
T87RPS-0002 9.4  5.4  1.3  3.2  410B   2  340B 840B 120B 850B 120B             4
T87RPS-0002                                                   -20B             5
T87RPS-0002                5.1       1.8   88   43   35  9.6                   8
 87RPS-0003482952808453750                TROUPE LAKE                          1
          87RPS-0003MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0003688 154  140 133 049 201 466 409 035016006 034 003 064004 07 998 2674
T87RPS-0003  -2   -1   -2B 920         6   16   17        -5   13 -0.1   51    1
T87RPS-0003  19    3    5   15  -10    5    3  483   28         8   57         2
T87RPS-0003       25       175            212                                  3
T87RPS-0003 9.7  5.9  1.4  3.6  440B   2  350B 870B 130B 870B 120B             4
T87RPS-0003                                                   -20B             5
T87RPS-0003                6.6       2.0   91   47   37   10                   8
 87RPS-0004482919408454389                TROUPE LAKE                          1
          87RPS-0004MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0004692 156  130 113 058 169 460 388 036013006 013 001 052005 05 992 2714
T87RPS-0004  -2   -1   -2B 875         5   13   10        -5   11  0.1   45    1
T87RPS-0004 8.0    3    5    7  -10   -5    2  492   25         7   56         2
T87RPS-0004       29       192            202                                  3
T87RPS-0004 8.5  4.9  1.2  2.8  390B 1.7  300B 740B 110B 750B 100B             4
T87RPS-0004                                                   -20B             5
T87RPS-0004                6.1       1.6   82   41   31  8.8                   8
 87RPS-0006482955608456500                TROUPE LAKE                          1
          87RPS-0006MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0006688 160  108 113 041 170 481 424 025010005 010 001 063005 05 994 2684
T87RPS-0006  -2   -1   -2B1060         6   13    9        -5   13 -0.1   42    1
T87RPS-0006  17    3   -5    5  -10   -5    2  502   20         7   50         2
T87RPS-0006       25       183            194                                  3
T87RPS-0006 8.7  4.9  1.2    3  370B 1.7  310B 820B 110B 810B 120B             4
T87RPS-0006                                                   -20B             5
T87RPS-0006                5.8       2.0   79   45   31  9.1                   8
 87RPS-0007482944408453417                TROUPE LAKE                          1
          87RPS-0007MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0007606 190  113 259 082 264 920 008 040020006 116 006 115006 18 992 2674
T87RPS-0007  -2   -1   -2B  48        11   14    6        -5  -10 -0.1   32    1
T87RPS-0007 1.2   -1   10   -5  -10    6    3  166   40        10   35         2
T87RPS-0007       25        -5            231                                  3
T87RPS-0007  12  7.5  1.8  4.5  530B 2.6  440B   1  150B   1  140B             4
T87RPS-0007                                                   -20B             5
T87RPS-0007                8.8       1.7  115   55   48   12                   8
 87RPS-0008483066708454778                TROUPE LAKE                          1
          87RPS-0008MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0008672 161  147 126 081 220 491 420 030013006 016 001 057005 04 994 2684
T87RPS-0008  -2  1.0   -2B 810         7   19   11         6   12  0.1   45    1
T87RPS-0008  42    3    6    7  -10    9    3  485   33         7   53         2
T87RPS-0008       27       207            190                                  3
T87RPS-0008 8.5  4.9  1.3  3.1  390B 1.9  320B 810B 130B 850B 120B             4
T87RPS-0008                                                   -20B             5
T87RPS-0008                6.0       2.7   83   45   32    9                   8
 87RPS-0009483058308455917                TROUPE LAKE                          1
          87RPS-0009MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0009683 162  113 133 052 190 459 461 027012005 007 001 049005 04 996 2674
```

```
T87RPS-0009  -2   -1   -2B 930        6   14   12        -5   13  0.1   41    1
T87RPS-0009  14    3    5   10  -10    5    3  482   24         7   51         2
T87RPS-0009         25        204            201                                3
T87RPS-0009 8.6  4.6  1.2  2.9  330B 1.6  280B 700B 100B 750B 110B              4
T87RPS-0009                                                  -20B               5
T87RPS-0009                   5.3       1.6   86   45   32    8                 8
 87RPS-0011483027808454472                TROUPE LAKE                           1
          87RPS-0011MONZONITE,QUARTZ  INTR      ARCH                            2
 87RPS-0011699 157  111 079 025 148 469 431 020007004 011 001 056005 05 993 2664
T87RPS-0011  -2   -1   -2B 720        4   10   10        -5   11 -0.1   29    1
T87RPS-0011  21    3   -5    6  -10   -5   -2  391   16         5   54          2
T87RPS-0011         26        183            170                                3
T87RPS-0011 6.2  3.7  940B 2.3  270B 1.4  230B 570B  90B 610B  90B              4
T87RPS-0011                                                  -20B               5
T87RPS-0011                   5.3       1.5   63   32   22  6.6                 8
```

SAGE
TROUPE LAKE: ISOTOPE SAMPLES

MAJOR OXIDE LISTING

	87RPS-0002	87RPS-0003	87RPS-0004	87RPS-0006	87RPS-0007	87RPS-0008
SiO2	00.00	68.80	69.20	68.80	60.60	67.20
Al2O3	00.00	15.40	15.60	16.00	19.00	16.10
Fe2O3	00.00	1.40	1.30	1.08	1.13	1.47
FeO	1.26	1.33	1.13	1.13	2.59	1.26
MgO	00.00	0.49	0.58	0.41	0.82	0.81
CaO	00.00	2.01	1.69	1.70	2.64	2.20
Na2O	00.00	4.66	4.60	4.81	9.20	4.91
K2O	00.00	4.09	3.88	4.24	0.08	4.20
TiO2	00.00	0.35	0.36	0.25	0.40	0.30
P2O5	00.00	0.16	0.13	0.10	0.20	0.13
MnO	00.00	0.06	0.06	0.05	0.06	0.06
CO2	0.15	0.34	0.13	0.10	1.16	0.16
S	0.02	0.03	0.01	0.01	0.06	0.01
H2O+	0.65	0.64	0.52	0.63	1.15	0.57
H2O-	0.07	0.04	0.05	0.05	0.06	0.05
LOI	0.50	0.70	0.50	0.50	1.80	0.40
TOTAL	00.00	99.80	99.20	99.40	99.20	99.40
S.G.	2.66	2.67	2.71	2.68	2.67	2.68

TRACE ELEMENT LISTING

	METHOD	87RPS-0002	87RPS-0003	87RPS-0004	87RPS-0006	87RPS-0007	87RPS-0008
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	-1	-1	-1	-1	-1	1
Au	AA	-2 B	-2 B	-2 B	-2 B	-2 B	-2 B
Ba	AA	850	920	875	1060	48	810
Co	AA	6	6	5	6	11	7
Cr	AA	11	16	13	13	14	19
Cu	AA	9	17	10	9	6	11
Ni	AA	-5	-5	-5	-5	-5	6
Pb	AA	12	13	11	13	-10	12
Sb	AA	-0.1	-0.1	0.1	-0.1	-0.1	0.1
Zn	AA	39	51	45	42	32	45
B	ICP/OES	5.9	19	8	17	1.2	42
Be	ICP/OES	3	3	3	3	-1	3
Co	ICP/OES	6	5	5	-5	10	6
Cu	ICP/OES	8	15	7	5	-5	7
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Ni	ICP/OES	9	5	-5	-5	6	9
Sc	ICP/OES	3	3	2	2	3	3
Sr	ICP/OES	440	483	492	502	166	485
V	ICP/OES	28	28	25	20	40	33
Y	ICP/OES	7	8	7	7	10	7
Zn	ICP/OES	38	57	56	50	35	53
Ga	XRF	25	25	29	25	25	27
Rb	XRF	187	175	192	183	-5	207

Zr	XRF	193	212	202	194	231	190
Pr	ICP-MS	9.4	9.7	8.5	8.7	12	8.5
Sm	ICP-MS	5.4	5.9	4.9	4.9	7.5	4.9
Eu	ICP-MS	1.3	1.4	1.2	1.2	1.8	1.3
Gd	ICP-MS	3.2	3.6	2.8	3	4.5	3.1

Tb	ICP-MS	410	B	440	B	390	B	370	B	530	B	390	B
Dy	ICP-MS	2		2		1.7		1.7		2.6		1.9	
Ho	ICP-MS	340	B	350	B	300	B	310	B	440	B	320	B
Er	ICP-MS	840	B	870	B	740	B	820	B	1		810	B
Tm	ICP-MS	120	B	130	B	110	B	110	B	150	B	130	B
Yb	ICP-MS	850	B	870	B	750	B	810	B	1		850	B
Lu	ICP-MS	120	B	120	B	100	B	120	B	140	B	120	B
Te		-20	B	-20	B	-20	B	-20	B	-20	B	-20	B
Hf	ICP-MS	5.1		6.6		6.1		5.8		8.8		6	
Sn	ICP-MS	1.8		2		1.6		2		1.7		2.7	
Ce	ICP-MS	88		91		82		79		115		83	
La	ICP-MS	43		47		41		45		55		45	
Nd	ICP-MS	35		37		31		31		48		32	
Y	ICP-MS	9.6		10		8.8		9.1		12		9	

MAJOR OXIDE LISTING

	87RPS-0009	87RPS-0011
SiO2	68.30	69.90
Al2O3	16.20	15.70
Fe2O3	1.13	1.11
FeO	1.33	0.79
MgO	0.52	0.25
CaO	1.90	1.48
Na2O	4.59	4.69
K2O	4.61	4.31
TiO2	0.27	0.20
P2O5	0.12	0.07
MnO	0.05	0.04
CO2	0.07	0.11
S	0.01	0.01
H2O+	0.49	0.56
H2O-	0.05	0.05
LOI	0.40	0.50
TOTAL	99.60	99.30
S.G.	2.67	2.66

TRACE ELEMENT LISTING

	METHOD	87RPS-0009	87RPS-0011
Ag	AA	-2	-2
As	AA	-1	-1
Au	AA	-2 B	-2 B
Ba	AA	930	720
Co	AA	6	4
Cr	AA	14	10
Cu	AA	12	10
Ni	AA	-5	-5
Pb	AA	13	11
Sb	AA	0.1	-0.1
Zn	AA	41	29
B	ICP/OES	14	21
Be	ICP/OES	3	3
Co	ICP/OES	5	-5
Cu	ICP/OES	10	6
Mo	ICP/OES	-10	-10
Ni	ICP/OES	5	-5
Sc	ICP/OES	3	-2
Sr	ICP/OES	482	391
V	ICP/OES	24	16
Y	ICP/OES	7	5
Zn	ICP/OES	51	54
Ga	XRF	25	26
Rb	XRF	204	183
Zr	XRF	201	170
Pr	ICP-MS	8.6	6.2

Sm	ICP-MS	4.6	3.7
Eu	ICP-MS	1.2	940 B
Gd	ICP-MS	2.9	2.3
Tb	ICP-MS	330 B	270 B
Dy	ICP-MS	1.6	1.4

Ho	ICP-MS	280	B	230	B
Er	ICP-MS	700	B	570	B
Tm	ICP-MS	100	B	90	B
Yb	ICP-MS	750	B	610	B
Lu	ICP-MS	110	B	90	B
Te		-20	B	-20	B
Hf	ICP-MS	5.3		5.3	
Sn	ICP-MS	1.6		1.5	
Ce	ICP-MS	86		63	
La	ICP-MS	45		32	
Nd	ICP-MS	32		22	
Y	ICP-MS	8		6.6	

```
          MAJOR OXIDE STATISTICS

          TOTAL NUMBER OF SAMPLES:          8


             MEAN   STD. DEVIATION
SiO2      59.10         24.06
Al2O3     14.25          5.87
Fe2O3      1.08          0.46
FeO        1.35          0.53
MgO        0.48          0.27
CaO        1.70          0.78
Na2O       4.68          2.46
K2O        3.18          1.95
TiO2       0.27          0.13
P2O5       0.11          0.06
MnO        0.05          0.02
CO2        0.28          0.37
S          0.02          0.02
H2O+       0.65          0.21
H2O-       0.05          0.01
LOI        0.66          0.47
TOTAL     86.99         35.15
S.G.       2.67          0.02
```

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	8	-2.00	0.00
As	8	-0.75	0.71
Au	8	-2.00	0.00
Ba	8	776.62	310.45
Co	8	6.37	2.07
Cr	8	13.75	2.82
Cu	8	10.50	3.16
Ni	8	-3.62	3.89
Pb	8	9.37	7.87
Sb	8	-0.03	0.10
Zn	8	40.50	7.17
B	8	16.01	12.54
Be	8	2.50	1.41
Co	8	3.37	5.42
Cu	8	6.62	5.63
Mo	8	-10.00	0.00
Ni	8	2.37	6.30
Sc	8	2.12	1.73
Sr	8	430.12	112.68
V	8	26.75	7.46
Y	8	7.25	1.39
Zn	8	49.25	8.24
Ga	8	25.87	1.46
Rb	8	165.75	69.84
Zr	8	199.12	17.68
Pr	8	8.95	1.61
Sm	8	5.22	1.11
Eu	8	118.68	331.87
Gd	8	3.17	0.65
Tb	8	391.25	76.43
Dy	8	1.86	0.36
Ho	8	321.25	60.81
Er	8	668.87	286.44
Tm	8	117.50	19.09
Yb	8	686.37	289.39
Lu	8	115.00	15.12
Te	8	-20.00	0.00
Hf	8	6.12	1.19
Sn	8	1.86	0.39
Ce	8	85.87	14.51
La	8	44.12	6.40
Nd	8	33.50	7.31
Y	8	9.14	1.56

```
□.{
□.I40;0;17:
□.NO;19:
□.MO;17;13;13;10:
SP1;VN;
VS10;
PA1200,1200;
SI0.156,0.260;DI-0.000,100.0;PA400,400;LBSAGE□;
PA1823,911;
SP1;
SI0.218,0.364;DI100.0,0.0;PA1823,6844;LBAFM PLOT:  TROUPE LAKE STOCK□;
SI0.324,0.540;DI100.0,0.0;PA4754,294;LB □;
PA7901,911;PD;PA7901,911,7901,857,7901,965,7901,911,7294,911,7294,857,
7294,965,7294,911,6686,911,6686,857,6686,965,6686,911,6078,911,6078,
857,6078,965,6078,911,5470,911,5470,857,5470,965,5470,911,4862,911,
4862,857,4862,965,4862,911,4254,911,4254,857,4254,965,4254,911,3647,
911,3647,857,3647,965,3647,911,3039,911,3039,857,3039,965,3039,911,
2431,911,2431,857,2431,965,2431,911,1823,911,1823,857,1823,965,1823,
911;PU;PA1823,911;SI0.324,0.540;DI-50.000,86.6;PA6971,3759;LB □;
PA4862,6175;PD;PA4862,6175,4909,6202,4815,6148,4862,6175,5166,5649,
5213,5676,5119,5622,5166,5649,5470,5123,5517,5150,5423,5096,5470,5123,
5774,4596,5821,4623,5727,4569,5774,4596,6078,4070,6125,4097,6031,4043,
6078,4070,6382,3543,6429,3570,6335,3516,6382,3543,6686,3017,6733,3044,
6639,2990,6686,3017,6990,2490,7037,2518,6943,2463,6990,2490,7294,1964,
7340,1991,7247,1937,7294,1964,7598,1438,7644,1465,7551,1411,7598,1438,
7901,911,7948,938,7855,884,7901,911;PU;PA7901,911;SI0.324,0.540;DI
-49.999,-86.602;PA2862,3946;LB □;
PA1823,911;PD;PA1823,911,1776,938,1870,884,1823,911,2127,1438,2080,
1465,2174,1411,2127,1438,2431,1964,2384,1991,2478,1937,2431,1964,2735,
2490,2688,2518,2782,2463,2735,2490,3039,3017,2992,3044,3086,2990,3039,
3017,3343,3543,3296,3570,3389,3516,3343,3543,3647,4070,3600,4097,3693,
4043,3647,4070,3950,4596,3904,4623,3997,4569,3950,4596,4254,5123,4208,
5150,4301,5096,4254,5123,4558,5649,4512,5676,4605,5622,4558,5649,4862,
6175,4815,6202,4909,6148,4862,6175;PU;PA4862,6175;SI0.173,0.288;DI
100.0,0.0;PA668,911;LBNA2O + K2O□;
SI0.173,0.288;DI100.0,0.0;PA8145,911;LBMGO□;
SI0.173,0.288;DI100.0,0.0;PA4558,6297;LBFEO (total)□;
SP6;
PA2753,2522;PD;PA2851,2586,2949,2651,3047,2715,3145,2779,3242,2843,
3340,2908,3438,2972,3536,3036,3634,3100,3732,3165,3830,3229,3928,3293,
4025,3357,4123,3422,4221,3486,4319,3550,4417,3614,4515,3679,4613,3743,
4711,3807,4710,3807,4795,3847,4868,3870,4931,3872,4984,3859,5031,3835,
5075,3807,5118,3776,5160,3743,5197,3701,5198,3703,5235,3662,5272,3620,
5308,3579,5345,3538,5382,3496,5419,3455,5456,3413,5493,3372,5529,3330,
5566,3289,5603,3247,5640,3206,5677,3164,5714,3123,5751,3081,5787,3040,
5824,2999,5861,2957,5898,2916,5935,2874,5972,2833;PU;PA1823,911;SP1;
SI0.063,0.106;DI100.0,0.0;PA2550,1904;PD;PA2528,1926,2571,1883,2550,
1904,2528,1883,2571,1926,2550,1904;PU;PA2550,1904;SI0.063,0.106;DI
100.0,0.0;PA4862,6175;PD;PA4841,6197,4884,6154,4862,6175,4841,6154,
4884,6197,4862,6175;PU;PA4862,6175;SI0.063,0.106;DI100.0,0.0;PA2740,
2064;PD;PA2719,2085,2761,2042,2740,2064,2719,2042,2761,2085,2740,2064;
PU;PA2740,2064;SI0.063,0.106;DI100.0,0.0;PA2749,1977;PD;PA2727,1998,
2770,1956,2749,1977,2727,1956,2770,1998,2749,1977;PU;PA2749,1977;SI
0.063,0.106;DI100.0,0.0;PA2591,1868;PD;PA2570,1889,2612,1847,2591,
1868,2570,1847,2612,1889,2591,1868;PU;PA2591,1868;SI0.063,0.106;DI
100.0,0.0;PA2986,2296;PD;PA2965,2318,3008,2275,2986,2296,2965,2275,
3008,2318,2986,2296;PU;PA2986,2296;SI0.063,0.106;DI100.0,0.0;PA2845,
1999;PD;PA2823,2020,2866,1977,2845,1999,2823,1977,2866,2020,2845,1999;
PU;PA2845,1999;SI0.063,0.106;DI100.0,0.0;PA2676,1935;PD;PA2655,1956,
2697,1914,2676,1935,2655,1914,2697,1956,2676,1935;PU;PA2676,1935;SI
0.063,0.106;DI100.0,0.0;PA2453,1764;PD;PA2432,1786,2474,1743,2453,
1764,2432,1743,2474,1786,2453,1764;PU;PA2453,1764;SP0;
PA9725,9725;
IN;
□.)□.Z
```

```
 87RPS-0001482927808456500                TROUPE LAKE                          1
          87RPS-0001MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0001QUARTZ MONZONITE, M TO C-GR, MASSIVE, K-SPAR PHENOS 1.5CM*W429.60*7E3
 87RPS-0001678 163  108 120 029 173 487 418 024010005 014 001 0570   05 986 2674
T87RPS-0001  -2   -1   -2B 905         5   11    9        -5   19 -0.1   47    1
T87RPS-0001  12    3            -10         3  524   24         7              2
T87RPS-0001       23       183            204                                  3
T87RPS-0001                          2.1                                       8
 87RPS-0002482947208453611                TROUPE LAKE                          1
          87RPS-0002MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0002QUARTZ MONZONITE, K-SPAR PHENOS UP TO 2CM, M TO C-GR  *W430-166  *7E3
 87RPS-0002             126                           015 002 065007 05     2664
T87RPS-0002  -2   -1   -2B 850         6   11    9        -5   12 -0.1   39    1
T87RPS-0002 5.9    3    6    8  -10    9    3  440   28         7   38         2
T87RPS-0002       25       187            193                                  3
T87RPS-0002 9.4  5.4  1.3  3.2  410B   2  340B 840B 120B 850B 120B             4
T87RPS-0002                                                   -20B             5
T87RPS-0002                5.1       1.8   88   43   35  9.6                   8
 87RPS-0003482952808453750                TROUPE LAKE                          1
          87RPS-0003MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0003QUARTZ MONZONITE, M TO C-GR, ZONED PHENOS, INEQUIGRAN  *W430-163 *7E3
 87RPS-0003688 154  140 133 049 201 466 409 035016006 034 003 064004 07 998 2674
T87RPS-0003  -2   -1   -2B 920         6   16   17        -5   13 -0.1   51    1
T87RPS-0003  19    3    5   15  -10    5    3  483   28         8   57         2
T87RPS-0003       25       175            212                                  3
T87RPS-0003 9.7  5.9  1.4  3.6  440B   2  350B 870B 130B 870B 120B             4
T87RPS-0003                                                   -20B             5
T87RPS-0003                6.6       2.0   91   47   37   10                   8
 87RPS-0004482919408454389                TROUPE LAKE                          1
          87RPS-0004MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0004QUARTZ MONZONITE, MASSIVE, INEQUIGRAN, PORPH,-UP TO 20%*W430-147 *7E3
 87RPS-0004692 156  130 113 058 169 460 388 036013006 013 001 052005 05 992 2714
T87RPS-0004  -2   -1   -2B 875         5   13   10        -5   11  0.1   45    1
T87RPS-0004 8.0    3    5    7  -10   -5    2  492   25         7   56         2
T87RPS-0004       29       192            202                                  3
T87RPS-0004 8.5  4.9  1.2  2.8  390B 1.7  300B 740B 110B 750B 100B             4
T87RPS-0004                                                   -20B             5
T87RPS-0004                6.1       1.6   82   41   31  8.8                   8
 87RPS-0005482922208454361                TROUPE LAKE                          1
          87RPS-0005MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0005QUARTZ MONZONITE, MASSIVE, PHENOS APPEAR ZONED        *W430-149  *7E3
 87RPS-0005673 162  157 106 069 193 483 427 026014005 010 001 080005 05 993 2674
T87RPS-0005  -2   -1   -2B 875         6   20    8         5  -10 -0.1   35    1
T87RPS-0005  10    3            -10         3  481   33         8              2
T87RPS-0005       27       142            187                                  3
T87RPS-0005                          2.4                                       8
 87RPS-0006482955608456500                TROUPE LAKE                          1
          87RPS-0006MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0006QUARTZ MONZONITE, M TO C-GR, K-SPAR PHENOS UP TO 1.5CM *429-59   *7E3
 87RPS-0006688 160  108 113 041 170 481 424 025010005 010 001 063005 05 994 2684
T87RPS-0006  -2   -1   -2B1060         6   13    9        -5   13 -0.1   42    1
T87RPS-0006  17    3   -5    5  -10   -5    2  502   20         7   50         2
T87RPS-0006       25       183            194                                  3
T87RPS-0006 8.7  4.9  1.2    3  370B 1.7  310B 820B 110B 810B 120B             4
T87RPS-0006                                                   -20B             5
T87RPS-0006                5.8       2.0   79   45   31  9.1                   8
 87RPS-0007482944408453417                TROUPE LAKE                          1
```

```
          87RPS-0007MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0007QUARTZ MONZONITE, K-SPAR PHENOS UP TO 3CM, INEQUIGRAN  *W430-173 *7E3
 87RPS-0007606 190  113 259 082 264 920 008 040020006 116 006 115006 18 992 2674
T87RPS-0007  -2   -1   -2B  48        11   14    6        -5  -10 -0.1   32    1
T87RPS-0007 1.2   -1   10   -5  -10    6    3  166   40        10   35         2
T87RPS-0007       25        -5            231                                  3
T87RPS-0007  12  7.5  1.8  4.5  530B 2.6  440B   1  150B   1  140B             4
T87RPS-0007                                                   -20B             5
T87RPS-0007                8.8       1.7  115   55   48   12                   8
 87RPS-0008483066708454778                TROUPE LAKE                          1
          87RPS-0008MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0008QUARTZ MONZONITE, M TO C-GR, PINK, FP PHENOS: 10-15%   *W429-50  *7E3
 87RPS-0008672 161  147 126 081 220 491 420 030013006 016 001 057005 04 994 2684
T87RPS-0008  -2  1.0   -2B 810         7   19   11         6   12  0.1   45    1
T87RPS-0008  42    3    6    7  -10    9    3  485   33         7   53         2
T87RPS-0008       27       207            190                                  3
T87RPS-0008 8.5  4.9  1.3  3.1  390B 1.9  320B 810B 130B 850B 120B             4
T87RPS-0008                                                   -20B             5
T87RPS-0008                6.0       2.7   83   45   32    9                   8
 87RPS-0009483058308455917                TROUPE LAKE                          1
          87RPS-0009MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0009QUARTZ MONZONITE, M TO C-GR, PINK, INEQUIGRAN,PORPH   *W429-42   *7E3
 87RPS-0009683 162  113 133 052 190 459 461 027012005 007 001 049005 04 996 2674
T87RPS-0009  -2   -1   -2B 930         6   14   12        -5   13  0.1   41    1
T87RPS-0009  14    3    5   10  -10    5    3  482   24         7   51         2
T87RPS-0009       25       204            201                                  3
T87RPS-0009 8.6  4.6  1.2  2.9  330B 1.6  280B 700B 100B 750B 110B             4
T87RPS-0009                                                   -20B             5
T87RPS-0009                5.3       1.6   86   45   32    8                   8
 87RPS-0010483041708453750                TROUPE LAKE                          1
          87RPS-0010MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0010QUARTZ MONZONITE, M TO C-GR, PINK, INEQUIGRAN., PORPH *W469-100A *7E3
 87RPS-0010684 157  153 113 057 206 465 360 029015005 011 002 0820   06 991 2684
T87RPS-0010  -2   -1   28B 735         5   15    9        -5   14 -0.1   47    1
T87RPS-0010 7.9    3            -10         2  512   26         8              2
T87RPS-0010       24       147            207                                  3
T87RPS-0010                          2.9                                       8
 87RPS-0011483027808454472                TROUPE LAKE                          1
          87RPS-0011MONZONITE,QUARTZ  INTR      ARCH                           2
 87RPS-0011QUARTZ MONZONITE, M TO C-GR, PINK, INEQUIGRAN., PORPH  *W469-105 *7E3
 87RPS-0011699 157  111 079 025 148 469 431 020007004 011 001 056005 05 993 2664
T87RPS-0011  -2   -1   -2B 720         4   10   10        -5   11 -0.1   29    1
T87RPS-0011  21    3   -5    6  -10   -5   -2  391   16         5   54         2
T87RPS-0011       26       183            170                                  3
T87RPS-0011 6.2  3.7  940B 2.3  270B 1.4  230B 570B  90B 610B  90B             4
T87RPS-0011                                                   -20B             5
T87RPS-0011                5.3       1.5   63   32   22  6.6                   8
```

```
□.(
□.I40;0;17:
□.N0;19:
□.M0;17;13;13;10:
SP1;VN;
VS10;
PA1200,1200;
SI0.156,0.260;DI-0.000,100.0;PA400,400;LBSAGE□;
PA1823,911;
SP1;
SI0.218,0.364;DI100.0,0.0;PA1823,6844;
LBJENSEN PLOT:  TROUPE LAKE STOCK□;
SI0.324,0.540;DI100.0,0.0;PA4754,294;LB □;
PA7901,911;PD;PA7901,911,7901,857,7901,965,7901,911,7294,911,7294,857,
7294,965,7294,911,6686,911,6686,857,6686,965,6686,911,6078,911,6078,
857,6078,965,6078,911,5470,911,5470,857,5470,965,5470,911,4862,911,
4862,857,4862,965,4862,911,4254,911,4254,857,4254,965,4254,911,3647,
911,3647,857,3647,965,3647,911,3039,911,3039,857,3039,965,3039,911,
2431,911,2431,857,2431,965,2431,911,1823,911,1823,857,1823,965,1823,
911;PU;PA1823,911;SI0.324,0.540;DI-50.000,86.6;PA6971,3759;LB □;
PA4862,6175;PD;PA4862,6175,4909,6202,4815,6148,4862,6175,5166,5649,
5213,5676,5119,5622,5166,5649,5470,5123,5517,5150,5423,5096,5470,5123,
5774,4596,5821,4623,5727,4569,5774,4596,6078,4070,6125,4097,6031,4043,
6078,4070,6382,3543,6429,3570,6335,3516,6382,3543,6686,3017,6733,3044,
6639,2990,6686,3017,6990,2490,7037,2518,6943,2463,6990,2490,7294,1964,
7340,1991,7247,1937,7294,1964,7598,1438,7644,1465,7551,1411,7598,1438,
7901,911,7948,938,7855,884,7901,911;PU;PA7901,911;SI0.324,0.540;DI
-49.999,-86.602;PA2862,3946;LB □;
PA1823,911;PD;PA1823,911,1776,938,1870,884,1823,911,2127,1438,2080,
1465,2174,1411,2127,1438,2431,1964,2384,1991,2478,1937,2431,1964,2735,
2490,2688,2518,2782,2463,2735,2490,3039,3017,2992,3044,3086,2990,3039,
3017,3343,3543,3296,3570,3389,3516,3343,3543,3647,4070,3600,4097,3693,
4043,3647,4070,3950,4596,3904,4623,3997,4569,3950,4596,4254,5123,4208,
5150,4301,5096,4254,5123,4558,5649,4512,5676,4605,5622,4558,5649,4862,
6175,4815,6202,4909,6148,4862,6175;PU;PA4862,6175;SI0.173,0.288;DI
100.0,0.0;PA1458,911;LBAl□;
SI0.173,0.288;DI100.0,0.0;PA8114,911;LBMg□;
SI0.173,0.288;DI100.0,0.0;PA4376,6297;LBFe3 + Fe2 + Ti□;
SP6;
PA2127,1438;PD;PA2220,1493,2313,1549,2406,1605,2499,1661,2592,1716,
2685,1772,2778,1828,2871,1884,2964,1939,3057,1995,3150,2051,3243,2107,
3335,2162,3428,2218,3521,2274,3614,2329,3707,2385,3707,2385,3792,2426,
3858,2436,3911,2422,3955,2393,3993,2353,4027,2306,4058,2256,4089,2204,
4119,2151,4149,2098,4179,2043,4207,1987,4235,1930,4262,1872,4288,1812,
4314,1751,4341,1692,4370,1638;PU;PA4370,1638,3343,3543;PD;PA3373,3491,
3403,3438,3434,3385,3464,3333,3495,3280,3525,3227,3555,3175,3586,3122,
3616,3070,3647,3017,3677,2964,3707,2912,3738,2859,3768,2806,3799,2754,
3828,2700,3854,2640,3877,2574,3896,2501,3911,2422;PU;PA3911,2422,4072,
2227;PD;PA4152,2276,4232,2325,4312,2374,4391,2423,4471,2471,4551,2520,
4631,2569,4711,2618,4791,2667,4871,2715;PU;PA4871,2715,3920,2438;PD;PA
4013,2493,4106,2549,4199,2605,4292,2660,4384,2716,4477,2771,4570,2827,
4663,2882,4756,2938,4849,2994;PU;PA4849,2994,4209,1991;PD;PA4274,2030,
4339,2069,4404,2108,4469,2147,4534,2185,4599,2224,4664,2263,4729,2302,
4794,2341,4859,2380;PU;PA4859,2380,3039,911;PD;PA2579,1708;PU;PA3647,
911;PD;PA2735,2490;PU;PA3039,3017;PD;PA3950,1438;PU;PA4862,911;PD;PA
4862,3754;PU;PA5470,911;PD;PA6686,3017;PU;PA6686,3017,1823,911;SP1;
SI0.063,0.106;DI100.0,0.0;PA2225,1397;PD;PA2204,1418,2246,1376,2225,
1397,2204,1376,2246,1418,2225,1397;PU;PA2225,1397;SI0.063,0.106;DI
100.0,0.0;PA4862,6175;PD;PA4841,6197,4884,6154,4862,6175,4841,6154,
4884,6197,4862,6175;PU;PA4862,6175;SI0.063,0.106;DI100.0,0.0;PA2378,
1511;PD;PA2357,1533,2399,1490,2378,1511,2357,1490,2399,1533,2378,1511;
PU;PA2378,1511;SI0.063,0.106;DI100.0,0.0;PA2379,1450;PD;PA2358,1471,
2400,1429,2379,1450,2358,1429,2400,1471,2379,1450;PU;PA2379,1450;SI
0.063,0.106;DI100.0,0.0;PA2273,1390;PD;PA2251,1411,2294,1368,2273,
1390,2251,1368,2294,1411,2273,1390;PU;PA2273,1390;SI0.063,0.106;DI
100.0,0.0;PA2473,1560;PD;PA2452,1581,2494,1538,2473,1560,2452,1538,
2494,1581,2473,1560;PU;PA2473,1560;SI0.063,0.106;DI100.0,0.0;PA2469,
1468;PD;PA2448,1489,2491,1446,2469,1468,2448,1446,2491,1489,2469,1468;
PU;PA2469,1468;SI0.063,0.106;DI100.0,0.0;PA2336,1429;PD;PA2314,1450,
2357,1407,2336,1429,2314,1407,2357,1450,2336,1429;PU;PA2336,1429;SI
0.063,0.106;DI100.0,0.0;PA2177,1334;PD;PA2156,1355,2198,1312,2177,
1334,2156,1312,2198,1355,2177,1334;PU;PA2177,1334;SP0;
PA9725,9725;
IN;
□.)□.Z
```

TROUP LAKE SAMPLES

MAJOR OXIDE LISTING
WEIGHT PERCENT

	87RPS-0001	87RPS-0002	87RPS-0003	87RPS-0004	87RPS-0005	87RPS-0006
SiO2	67.80	00.00	68.80	69.20	67.30	68.80
Al2O3	16.30	00.00	15.40	15.60	16.20	16.00
Fe2O3	1.08	00.00	1.40	1.30	1.57	1.08
FeO	1.20	1.26	1.33	1.13	1.06	1.13
MgO	0.29	00.00	0.49	0.58	0.69	0.41
CaO	1.73	00.00	2.01	1.69	1.93	1.70
Na2O	4.87	00.00	4.66	4.60	4.83	4.81
K2O	4.18	00.00	4.09	3.88	4.27	4.24
TiO2	0.24	00.00	0.35	0.36	0.26	0.25
P2O5	0.10	00.00	0.16	0.13	0.14	0.10
MnO	0.05	00.00	0.06	0.06	0.05	0.05
CO2	0.14	0.15	0.34	0.13	0.10	0.10
S	0.01	0.02	0.03	0.01	0.01	0.01
H2O+	0.57	0.65	0.64	0.52	0.80	0.63
H2O-	00.00	0.07	0.04	0.05	0.05	0.05
LOI	0.50	0.50	0.70	0.50	0.50	0.50
TOTAL	98.60	2.15	99.80	99.20	99.30	99.40
S.G.	2.67	2.66	2.67	2.71	2.67	2.68

TRACE ELEMENT LISTING

	METHOD	87RPS-0001	87RPS-0002	87RPS-0003	87RPS-0004	87RPS-0005	87RPS-0006
Ag	AA	-2	-2	-2	-2	-2	-2
As	AA	-1	-1	-1	-1	-1	-1
Au	AA	-2 B	-2 B	-2 B	-2 B	-2 B	-2 B
Ba	AA	905	850	920	875	875	1060
Co	AA	5	6	6	5	6	6
Cr	AA	11	11	16	13	20	13
Cu	AA	9	9	17	10	8	9
Ni	AA	-5	-5	-5	-5	5	-5
Pb	AA	19	12	13	11	-10	13
Sb	AA	-0.10	-0.10	-0.10	0.10	-0.10	-0.10
Zn	AA	47	39	51	45	35	42
B	ICP/OES	12	5.90	19	8	10	17
Be	ICP/OES	3	3	3	3	3	3
Co	ICP/OES		6	5	5		-5
Cu	ICP/OES		8	15	7		5
Mo	ICP/OES	-10	-10	-10	-10	-10	-10
Ni	ICP/OES		9	5	-5		-5
Sc	ICP/OES	3	3	3	2	3	2
Sr	ICP/OES	524	440	483	492	481	502
V	ICP/OES	24	28	28	25	33	20
Y	ICP/OES	7	7	8	7	8	7
	ICP/OES		38	57	56		50
Ga	XRF	23	25	25	29	27	25
Rb	XRF	183	187	175	192	142	183
Zr	XRF	204	193	212	202	187	194

Pr	ICP-MS		9.40		9.70		8.50			8.70	
Sm	ICP-MS		5.40		5.90		4.90			4.90	
Eu	ICP-MS		1.30		1.40		1.20			1.20	
Gd	ICP-MS		3.20		3.60		2.80			3	
Tb	ICP-MS		410	B	440	B	390	B		370	B
Dy	ICP-MS		2		2		1.70			1.70	
Ho	ICP-MS		340	B	350	B	300	B		310	B
Er	ICP-MS		840	B	870	B	740	B		820	B
Tm	ICP-MS		120	B	130	B	110	B		110	B
Yb	ICP-MS		850	B	870	B	750	B		810	B
Lu	ICP-MS		120	B	120	B	100	B		120	B
Te			-20	B	-20	B	-20	B		-20	B
Hf	ICP-MS		5.10		6.60		6.10			5.80	
Sn	ICP-MS	2.10	1.80		2		1.60		2.40	2	
Ce	ICP-MS		88		91		82			79	
La	ICP-MS		43		47		41			45	
Nd	ICP-MS		35		37		31			31	
Y	ICP-MS		9.60		10		8.80			9.10	

MAJOR OXIDE LISTING
WEIGHT PERCENT

	87RPS-0007	87RPS-0008	87RPS-0009	87RPS-0010	87RPS-0011
SiO2	60.60	67.20	68.30	68.40	69.90
Al2O3	19.00	16.10	16.20	15.70	15.70
Fe2O3	1.13	1.47	1.13	1.53	1.11
FeO	2.59	1.26	1.33	1.13	0.79
MgO	0.82	0.81	0.52	0.57	0.25
CaO	2.64	2.20	1.90	2.06	1.48
Na2O	9.20	4.91	4.59	4.65	4.69
K2O	0.08	4.20	4.61	3.60	4.31
TiO2	0.40	0.30	0.27	0.29	0.20
P2O5	0.20	0.13	0.12	0.15	0.07
MnO	0.06	0.06	0.05	0.05	0.04
CO2	1.16	0.16	0.07	0.11	0.11
S	0.06	0.01	0.01	0.02	0.01
H2O+	1.15	0.57	0.49	0.82	0.56
H2O-	0.06	0.05	0.05	00.00	0.05
LOI	1.80	0.40	0.40	0.60	0.50
TOTAL	99.20	99.40	99.60	99.10	99.30
S.G.	2.67	2.68	2.67	2.68	2.66

TRACE ELEMENT LISTING

	METHOD	87RPS-0007	87RPS-0008	87RPS-0009	87RPS-0010	87RPS-0011
Ag	AA	-2	-2	-2	-2	-2
As	AA	-1	1	-1	-1	-1
Au	AA	-2 B	-2 B	-2 B	28 B	-2 B
Ba	AA	48	810	930	735	720
Co	AA	11	7	6	5	4
Cr	AA	14	19	14	15	10
Cu	AA	6	11	12	9	10
Ni	AA	-5	6	-5	-5	-5
Pb	AA	-10	12	13	14	11
Sb	AA	-0.10	0.10	0.10	-0.10	-0.10
Zn	AA	32	45	41	47	29
B	ICP/OES	1.20	42	14	7.90	21
Be	ICP/OES	-1	3	3	3	3
Co	ICP/OES	10	6	5		-5
Cu	ICP/OES	-5	7	10		6
Mo	ICP/OES	-10	-10	-10	-10	-10
Ni	ICP/OES	6	9	5		-5
Sc	ICP/OES	3	3	3	2	-2
Sr	ICP/OES	166	485	482	512	391
V	ICP/OES	40	33	24	26	16
Y	ICP/OES	10	7	7	8	5
	ICP/OES	35	53	51		54
Ga	XRF	25	27	25	24	26
Rb	XRF	-5	207	204	147	183
Zr	XRF	231	190	201	207	170
Pr	ICP-MS	12	8.50	8.60		6.20
Sm	ICP-MS	7.50	4.90	4.60		3.70
Eu	ICP-MS	1.80	1.30	1.20		940 B

Gd	ICP-MS	4.50		3.10		2.90			2.30	
Tb	ICP-MS	530	B	390	B	330	B		270	B
Dy	ICP-MS	2.60		1.90		1.60			1.40	
Ho	ICP-MS	440	B	320	B	280	B		230	B
Er	ICP-MS	1		810	B	700	B		570	B
Tm	ICP-MS	150	B	130	B	100	B		90	B
Yb	ICP-MS	1		850	B	750	B		610	B
Lu	ICP-MS	140	B	120	B	110	B		90	B
Te		-20	B	-20	B	-20	B		-20	B
Hf	ICP-MS	8.80		6		5.30			5.30	
Sn	ICP-MS	1.70		2.70		1.60		2.90	1.50	
Ce	ICP-MS	115		83		86			63	
La	ICP-MS	55		45		45			32	
Nd	ICP-MS	48		32		32			22	
Y	ICP-MS	12		9		8			6.60	

MAJOR OXIDE STATISTICS

TOTAL NUMBER OF SAMPLES: 11

	MEAN	STD. DEVIATION
SiO2	61.48	20.54
Al2O3	14.75	4.99
Fe2O3	1.16	0.43
FeO	1.29	0.46
MgO	0.49	0.25
CaO	1.76	0.66
Na2O	4.71	2.06
K2O	3.41	1.68
TiO2	0.27	0.11
P2O5	0.12	0.05
MnO	0.05	0.02
CO2	0.23	0.32
S	0.02	0.02
H2O+	0.67	0.19
H2O-	0.04	0.02
LOI	0.63	0.40
TOTAL	90.46	29.29
S.G.	2.67	0.01

TRACE ELEMENT STATISTICS

	NO. OF SAMPLES	MEAN	STD. DEVIATION
Ag	11	-2.00	0.00
As	11	-0.82	0.60
Au	11	0.73	9.05
Ba	11	793.45	264.47
Co	11	6.09	1.81
Cr	11	14.18	3.19
Cu	11	10.00	2.79
Ni	11	-3.09	4.25
Pb	11	8.91	9.60
Sb	11	-0.05	0.09
Zn	11	41.18	6.85
B	11	14.36	10.90
Be	11	2.64	1.21
Co	8	3.37	5.42
Cu	8	6.62	5.63
Mo	11	-10.00	0.00
Ni	8	2.37	6.30
Sc	11	2.27	1.49
Sr	11	450.73	101.15
V	11	27.00	6.60
Y	11	7.36	1.21
	8	49.25	8.24
Ga	11	25.55	1.63
Rb	11	163.45	59.41
Zr	11	199.18	15.56
Pr	8	8.95	1.61
Sm	8	5.22	1.11
Eu	8	118.68	331.87
Gd	8	3.17	0.65
Tb	8	391.25	76.43
Dy	8	1.86	0.36
Ho	8	321.25	60.81
Er	8	668.87	286.44
Tm	8	117.50	19.09
Yb	8	686.37	289.39
Lu	8	115.00	15.12
Te	8	-20.00	0.00
Hf	8	6.12	1.19
Sn	11	2.03	0.46
Ce	8	85.87	14.51
La	8	44.12	6.40
Nd	8	33.50	7.31
Y	8	9.14	1.56

```
 87RPS-0012482100008455222                ABOTOSSAWAY TWP                       1
          87RPS-0012FELSIC CRYSTAL TUFMETA      ARCH                            2
 87RPS-0012FELSIC CRYSTAL TUFF, FP UP TO 4MM,BROWN,FP=30%(U-PB) *W576-142   *3W3
 87RPS-0012605 150  189 319 169 379 566 023 045019006 545 001 1130   61 992 2764
T87RPS-0012  -2   -1   -2B 138        14   48   20        26  -10  0.1   53     1
T87RPS-0012  16   -1   14   17  -10   31    9  185   74         6   57          2
T87RPS-0012       27        -5            120                                   3
T87RPS-0012                          1.7                                        8
 87RPS-0013482263908487778                LALIBERT TWP                          1
          87RPS-0013QTZ-FP CRYSTAL TUFVOLC      ARCH                            2
 87RPS-0013QTZ-FP CRYSTAL TUFF, QTZ APPROX 5%,FP APPROX 20%(U-PB)*W775-26   *3Q 3
 87RPS-0013687 143  243 153 072 248 508 158 058015007 013 025 0800   09 988 2734
T87RPS-0013  -2   -1   -2B 518         9  -10   17          -5  -10  0.1   47     1
T87RPS-0013  13    1    8   13  -10    6    8  285   39          17   51          2
T87RPS-0013       23        44            218                                   3
T87RPS-0013                          3.0                                        8
 87RPS-0014480125008471111                MCMURRAY TWP                          1
          87RPS-0014QTZ-FP PORPHYRY   INTR      ARCH                            2
 87RPS-0014QTZ-FP PORPHYRY, FROM-GR,INEQUIGRAN, QTZ=15-205,(U-PB)*W90-17    *7A 3
 87RPS-0014693 141  106 173 062 259 415 218 024004005 221 004 132005 30 997 2694
T87RPS-0014  -2   -1   -2B 600         6   12   14          -5  -10 -0.1   34     1
T87RPS-0014  29    1    6   11  -10    7    6  128   29          11   36          2
T87RPS-0014       23        63            144                                   3
T87RPS-0014                          2.2                                        8
 87RPS-0015479908308471556                MCMURRAY TWP                          1
          87RPS-0015QTZ-PORPHYRY FLOW META      ARCH                            2
 87RPS-0015QTZ-PORPH FLOW,F-GR,QTZ.PHENOS UP TO 3MM AND 5% (U-PB) *W90-270  *7C3
 87RPS-0015769 122  058 073 003 085 355 371 011001002 038 001 064008 06 998 2654
T87RPS-0015  -2   -1   -2B 780        -5  -10    5          -5   18 -0.1   23     1
T87RPS-0015 5.0    1   -5   -5  -10   -5    4   77   -5          18   22          2
T87RPS-0015       23        92            136                                   3
T87RPS-0015 6.7  4.5  650B 3.8  600B 3.5  750B 2.1  310B 2.2  320B              4
T87RPS-0015                                                   -20B              5
T87RPS-0015                5.6       2.2   65   33   25   20                    8
 87RPS-0016483619408452028                FINAN TWP                             1
          87RPS-0016GRANODIORITE      INTR      ARCH                            2
 87RPS-0016GRANODIORITE, M-GR, EQUIGRAN,MASSIVE             (U-PB) *W523-304*1U3
 87RPS-0016722 148  043 040 007 126 397 463 014001002 027 001 060005 06 989 2644
T87RPS-0016  -2   -1   -2B 672        -5  -10    9          -5   22 -0.1   22     1
T87RPS-0016 5.7    2   -5    6  -10   -5   -2  240    7          -5   31          2
T87RPS-0016       24       169             81                                   3
T87RPS-0016                          2.6                                        8
 87RPS-0017482488908474556                LECLAIRE TWP                          1
          87RPS-0017FP CRYSTAL TUFF   VOLC      ARCH                            2
 87RPS-0017FP CRYSTAL TUFF, FP UP TO 4MM, LAPILLI TO BRECCIA(U-PB)*W334-08   *3W3
 87RPS-0017691 149  156 146 085 412 365 128 041022005 096 001 144005 211000 2764
T87RPS-0017  -2  1.0   -2B 183         6  -10   16          -5  -10 -0.1   38     1
T87RPS-0017  15   -1    6   12  -10   -5    5  578   67          11   41          2
T87RPS-0017       23        39            149                                   3
T87RPS-0017                          1.4                                        8
 87RPS-0018480733308464222                ESQUEGA TWP                           1
          87RPS-0018QTZ-FP CRYSTAL TUFVOLC      ARCH                            2
 87RPS-0018QTZ-FP CRYSTAL TUFF, QTZ UP TO 3MM,FP UP TO 4MM (U-PB) *W145-97   *3Q3
 87RPS-0018757 116  089 046 105 180 018 426 011001003 161 001 166008 30 994 2744
T87RPS-0018  -2   -1   -2B 608        -5  -10    5          -5  -10 -0.1   26     1
T87RPS-0018  30    1   -5   -5  -10    5    3   13   -5          22   26          2
T87RPS-0018       22       104             86                                   3
```

```
T87RPS-0018                          4.3                                       8
 87RPS0001D482927808456500                TROUPE LAKE                          1
         87RPS0001DMONZONITE,QUARTZ   INTR      ARCH                           2
 87RPS0001D * REFER TO SAMPLE 87RPS-0001 *                                     3
 87RPS0001D682 163  117 113 036 175 500 417 026011005 012 001 0600   05 992 2674
T87RPS0001D  -2   -1   -2B 915         5   11    9        -5   19 -0.1   46    1
T87RPS0001D 9.0    3    5    8  -10    5    2  514   23         7   51         2
T87RPS0001D       25       185            206                                  3
T87RPS0001D                          2.0                                       8
 87RPS0002D482947208453611                TROUPE LAKE                          1
         87RPS0002DMONZONITE,QUARTZ   INTR      ARCH                           2
 87RPS0002DQUARTZ MONZONITE, K-SPAR PHENOS UP TO 2CM, M TO C-GR  *W430-166  *7E3
 87RPS0002D             126                           014 001 063006        2664
T87RPS0002D  -2   -1   -2B 890         5   10    9        -5   14 -0.1   39    1
T87RPS0002D 7.6    3    6    9  -10   10    4  437   29         8   38         2
T87RPS0002D       23       188            195                                  3
T87RPS0002D                                                   -20B             5
 87RPS0015D479908308471556               MCMURRAY TWP                          1
         87RPS0015DQTZ-PORPHYRY FLOW META       ARCH                           2
 87RPS0015DQTZ-PORPH FLOW,F-GR,QTZ.PHENOS UP TO 3MM AND 5% (U-PB) *W90-270  *7C3
 87RPS0015D                                                                    4
T87RPS0015D 6.7  4.6  640B 3.9  610B 3.6  750B 2.3  340B 2.3  350B             4
T87RPS0015D                                66   34   26   21                   8
```

```
□□□Ö□□□IN;IW;PU;SP 0;SP
1;PU286,726PD271,711,264,689,264,659,271,637,286,622,301,622,316,630,323,637,331
,652,346,697,353,711,361,719,375,726,398,726,413,711,420,689,420,659,413,637,398
,622;PU264,815PD420,756;PU264,815PD420,875;PU368,778PD368,853;PU301,1016PD286,10
09,271,994,264,979,264,949,271,934,286,919,301,912,323,905,361,905,383,912,398,9
19,413,934,420,949,420,979,413,994,398,1009,383,1016,361,1016;PU361,979PD361,101
6;PU264,1068PD420,1068;PU264,1068PD264,1165;Ö□□□Ï□□□;PU338,1068PD338,1127;PU420,
1068PD420,1165;PU1862,6900PD1807,6756;PU1862,6900PD1917,6756;PU1827,6804PD1896,6
804;PU1951,6900PD1951,6756;PU1951,6900PD2040,6900;PU1951,6832PD2006,6832;PU2074,
6900PD2074,6756;PU2074,6900PD2129,6756;PU2184,6900PD2129,6756;PU2184,6900PD2184,
6756;PU2390,6900PD2390,6756;PU2390,6900PD2451,6900,2472,6893,2479,6886,2486,6873
,2486,6852,2479,6838,2472,6832,2451,6825,2390,6825;PU2534,6900PD2534,6756,2616,6
756;PU2685,6900PD2671,6893;Ï□□□Ë□□□;PD  2657,
6880,2650,6866,2643,6845,2643,6811,2650,6790,2657,6777,2671,6763,2685,6756,2712,
6756,2726,6763,2739,6777,2746,6790,2753,6811,2753,6845,2746,6866,2739,6880,2726,
6893,2712,6900,2685,6900;PU2829,6900PD2829,6756;PU2781,6900PD2877,6900;PU2918,68
52PD2911,6845,2918,6838,2925,6845,2918,6852;PU2918,6770PD2911,6763,2918,6756,292
5,6763,2918,6770;PU3309,6900PD3309,6756;PU3261,6900PD3357,6900;PU3391,6900PD3391
,6756;PU3391,6900PD3453,6900,3473,6893;Ë□□□Ö□□□;PD  3480,
6886,3487,6873,3487,6859,3480,6845,3473,6838,3453,6832,3391,6832;PU3439,6832PD34
87,6756;PU3569,6900PD3555,6893,3542,6880,3535,6866,3528,6845,3528,6811,3535,6790
,3542,6777,3555,6763,3569,6756,3597,6756,3610,6763,3624,6777,3631,6790,3638,6811
,3638,6845,3631,6866,3624,6880,3610,6893,3597,6900,3569,6900;PU3686,6900PD3686,6
797,3693,6777,3706,6763,3727,6756,3741,6756,3761,6763,3775,6777,3782,6797,3782,6
900;PU3837,6900PD3837,6756;PU3837,6900PD3898,6900;Ö□□□Ù□□□;PD  3919,
6893,3926,6886,3933,6873,3933,6852,3926,6838,3919,6832,3898,6825,3837,6825;PU398
1,6900PD3981,6756;PU3981,6900PD4070,6900;PU3981,6832PD4035,6832;PU3981,6756PD407
0,6756;PU4262,6900PD4262,6756,4344,6756;PU4413,6900PD4358,6756;PU4413,6900PD4467
,6756;PU4378,6804PD4447,6804;PU4502,6900PD4502,6756;PU4598,6900PD4502,6804;PU453
6,6838PD4598,6756;PU4646,6900PD4646,6756;PU4646,6900PD4735,6900;PU4646,6832PD470
1,6832;PU4646,6756PD4735,6756;PU5016,6880PD5002,6893;Ù□□□Ý□□□;PD  4982,
6900,4954,6900,4934,6893,4920,6880,4920,6866,4927,6852,4934,6845,4947,6838,4989,
6825,5002,6818,5009,6811,5016,6797,5016,6777,5002,6763,4982,6756,4954,6756,4934,
6763,4920,6777;PU5091,6900PD5091,6756;PU5043,6900PD5139,6900;PU5208,6900PD5194,6
893,5181,6880,5174,6866,5167,6845,5167,6811,5174,6790,5181,6777,5194,6763,5208,6
756,5235,6756,5249,6763,5263,6777,5270,6790,5277,6811,5277,6845,5270,6866,5263,6
880,5249,6893,5235,6900,5208,6900;PU5421,6866PD5414,6880;Ý□□□Ï□□□;PD  5400,
6893,5386,6900,5359,6900,5345,6893,5331,6880,5325,6866,5318,6845,5318,6811,5325,
6790,5331,6777,5345,6763,5359,6756,5386,6756,5400,6763,5414,6777,5421,6790;PU546
9,6900PD5469,6756;PU5565,6900PD5469,6804;PU5503,6838PD5565,6756;PU7800,900PD7800
,900,7800,879,7800,921,7800,900,7200,900,7200,879,7200,921,7200,900,6600,900,660
0,879,6600,921,6600,900,6000,900,6000,879,6000,921,6000,900,5400,900,5400,879,54
00,921,5400,900,4800,900,4800,879,4800,921;Ï□□□Ô□□□;PD  4800,
900,4200,900,4200,879,4200,921,4200,900,3600,900,3600,879,3600,921,3600,900,3000
,900,3000,879,3000,921,3000,900,2400,900,2400,879,2400,921,2400,900,1800,900,180
0,879,1800,921,1800,900;PU4800,6096PD4800,6096,4818,6107,4782,6086,4800,6096,510
0,5577,5118,5587,5082,5566,5100,5577,5400,5057,5418,5067,5382,5046,5400,5057,570
0,4537,5718,4548,5682,4527,5700,4537,6000,4018,6018,4028,5982,4007,6000,4018,630
0,3498,6318,3509,6282,3488,6300,3498,6600,2978;Ô□□□Ë□□□;PD  6618,
2989,6582,2968,6600,2978,6900,2459,6918,2469,6882,2448,6900,2459,7200,1939,7218,
1950,7182,1929,7200,1939,7500,1420,7518,1430,7482,1409,7500,1420,7800,900,7818,9
10,7782,889,7800,900;PU1800,900PD1800,900,1782,910,1818,889,1800,900,2100,1420,2
082,1430,2118,1409,2100,1420,2400,1939,2382,1950,2418,1929,2400,1939,2700,2459,2
682,2469,2718,2448,2700,2459,3000,2978,2982,2989,3018,2968,3000,2978,3300,3498,3
282,3509,3318,3488,3300,3498,3600,4018;Ë□□□Ô□□□;PD  3582,
4028,3618,4007,3600,4018,3900,4537,3882,4548,3918,4527,3900,4537,4200,5057,4182,
5067,4218,5046,4200,5057,4500,5577,4482,5587,4518,5566,4500,5577,4800,6096,4782,
6107,4818,6086,4800,6096;PU682,1014PD682,900;PU682,1014PD758,900;PU758,1014PD758
,900;PU828,1014PD785,900;PU828,1014PD872,900;PU801,938PD855,938;PU899,987PD899,9
92,904,1003,910,1009,921,1014,942,1014,953,1009,959,1003,964,992,964,981,959,971
,948,954,893,900,969,900;PU1035,1014PD1024,1009;O□□□Ð□□□;PD  1013,
998,1007,987,1002,971,1002,943,1007,927,1013,916,1024,905,1035,900,1056,900,1067
,905,1078,916,1083,927,1089,943,1089,971,1083,987,1078,998,1067,1009,1056,1014,1
035,1014;PU1295,998PD1295,900;PU1246,949PD1344,949;PU1507,1014PD1507,900;PU1583,
1014PD1507,938;PU1534,965PD1583,900;PU1621,987PD1621,992,1626,1003,1632,1009,164
3,1014,1664,1014,1675,1009,1681,1003,1686,992,1686,981,1681,971,1670,954,1615,90
0,1691,900;PU1757,1014PD1746,1009,1735,998;Ð□□□Ô□□□;PD  1729,
987,1724,971,1724,943,1729,927,1735,916,1746,905,1757,900,1778,900,1789,905,1800
,916,1805,927,1811,943,1811,971,1805,987,1800,998,1789,1009,1778,1014,1757,1014;
PU8062,1014PD8062,900;PU8062,1014PD8105,900;PU8149,1014PD8105,900;PU8149,1014PD8
149,900;PU8268,987PD8263,998,8252,1009,8241,1014,8219,1014,8208,1009,8197,998,81
92,987,8187,971,8187,943,8192,927,8197,916,8208,905,8219,900,8241,900,8252,905,8
263,916,8268,927,8268,943;PU8241,943PD8268,943;Ô□□□İ□□□;PU8333,1014PD8322,1009,8
311,998,8306,987,8301,971,8301,943,8306,927,8311,916,8322,905,8333,900,8355,900,
8366,905,8377,916,8382,927,8387,943,8387,971,8382,987,8377,998,8366,1009,8355,10
14,8333,1014;PU4522,6330PD4522,6216;PU4522,6330PD4592,6330;PU4522,6276PD4565,627
6;PU4619,6330PD4619,6216;PU4619,6330PD4690,6330;PU4619,6276PD4663,6276;PU4619,62
16PD4690,6216;PU4750,6330PD4739,6325,4728,6314,4723,6303,4717,6287,4717,6260,472
3,6243,4728,6232,4739,6222;İ□□□Ó□□□;PD  4750,
6216,4771,6216,4782,6222,4793,6232,4799,6243,4804,6260,4804,6287,4799,6303,4793,
6314,4782,6325,4771,6330,4750,6330;PU4999,6352PD4989,6341,4978,6325,4967,6303,49
61,6276,4961,6254,4967,6227,4978,6205,4989,6189,4999,6178;PU5043,6330PD5043,6238
,5048,6222,5059,6216,5070,6216;PU5027,6292PD5065,6292;PU5124,6292PD5113,6287,510
3,6276,5097,6260,5097,6249,5103,6232,5113,6222,5124,6216,5141,6216,5151,6222,516
2,6232,5168,6249,5168,6260,5162,6276,5151,6287;Ó□□□Ê□□□;PD  5141,
6292,5124,6292;PU5211,6330PD5211,6238,5217,6222,5227,6216,5238,6216;PU5195,6292P
D5233,6292;PU5331,6292PD5331,6216;PU5331,6276PD5320,6287,5309,6292,5293,6292,528
2,6287,5271,6276,5265,6260,5265,6249,5271,6232,5282,6222,5293,6216,5309,6216,532
0,6222,5331,6232;PU5374,6330PD5374,6216;PU5412,6352PD5423,6341,5434,6325,5445,63
03,5450,6276,5450,6254,5445,6227,5434,6205,5423,6189,5412,6178;PU;SP 0;SP
6;PU2718,2490PD2815,2553,2911,2617,3008,2680;Ê□□□Ñ□□□;PD  3104,
2744,3201,2807,3298,2871,3394,2934,3491,2997,3588,3061,3684,3124,3781,3188,3877,
3251,3974,3314,4071,3378,4167,3441,4264,3505,4360,3568,4457,3632,4554,3695,4650,
3758,4650,3758,4733,3798,4806,3820,4868,3823,4920,3810,4966,3786,5010,3758,5053,
3728,5094,3696,5130,3654,5131,3656,5168,3615,5204,3574,5240,3533,5277,3492,5313,
3451,5349,3411,5386,3370,5422,3329,5459,3288,5495,3247,5531,3206,5568,3165,5604,
3124,5640,3083,5677,3042,5713,3001,5750,2960;Ñ□□□Ê□□□;PD  5786,
2919,5822,2878,5859,2838,5895,2797;PU;SP 0;SP
1;PU2517,1880PD2538,1901;PU2496,1901PD2538,1859;PU2496,1859PD2517,1880;PU4800,60
96PD4821,6117;PU4779,6117PD4821,6075;PU4779,6075PD4800,6096;PU2705,2038PD2726,20
59;PU2684,2059PD2726,2017;PU2684,2017PD2705,2038;PU2714,1952PD2735,1973;PU2693,1
973PD2735,1931;PU2693,1931PD2714,1952;PU2743,1948PD2764,1969;PU2722,1969PD2764,1
927;PU2722,1927PD2743,1948;PU2558,1845PD2579,1866;PU2537,1866PD2579,1824;Ê□□□~□□
□;PU2537,1824PD2558,1845;PU2948,2267PD2969,2288;PU2927,2288PD2969,2246;PU2927,22
46PD2948,2267;PU2808,1973PD2829,1994;PU2787,1994PD2829,1952;PU2787,1952PD2808,19
73;PU2642,1911PD2663,1932;PU2621,1932PD2663,1890;PU2621,1890PD2642,1911;PU2766,2
050PD2787,2071;PU2745,2071PD2787,2029;PU2745,2029PD2766,2050;PU2422,1742PD2443,1
763;PU2401,1763PD2443,1721;PU2401,1721PD2422,1742;SP 0;~□□□
```

```
□□□Ô□□□IN;IW;PU;SP 0;SP
1;PU286,726PD271,711,264,689,264,659,271,637,286,622,301,622,316,630,323,637,331
,652,346,697,353,711,361,719,375,726,398,726,413,711,420,689,420,659,413,637,398
,622;PU264,815PD420,756;PU264,815PD420,875;PU368,778PD368,853;PU301,1016PD286,10
09,271,994,264,979,264,949,271,934,286,919,301,912,323,905,361,905,383,912,398,9
19,413,934,420,949,420,979,413,994,398,1009,383,1016,361,1016;PU361,979PD361,101
6;PU264,1068PD420,1068;PU264,1068PD264,1165;Ô□□□Ô□□□;PU338,1068PD338,1127;PU420,
1068PD420,1165;PU1882,6900PD1882,6790,1875,6770,1869,6763,1855,6756,1841,6756,18
27,6763,1821,6770,1814,6790,1814,6804;PU1937,6900PD1937,6756;PU1937,6900PD2026,6
900;PU1937,6832PD1992,6832;PU1937,6756PD2026,6756;PU2067,6900PD2067,6756;PU2067,
6900PD2163,6756;PU2163,6900PD2163,6756;PU2307,6880PD2294,6893,2273,6900,2246,690
0,2225,6893,2211,6880,2211,6866,2218,6852,2225,6845,2239,6838,2280,6825,2294,681
8,2301,6811,2307,6797,2307,6777;Ô□□□Ô□□□;PD  2294,
6763,2273,6756,2246,6756,2225,6763,2211,6777;PU2355,6900PD2355,6756;PU2355,6900P
D2445,6900;PU2355,6832PD2410,6832;PU2355,6756PD2445,6756;PU2486,6900PD2486,6756;
PU2486,6900PD2582,6756;PU2582,6900PD2582,6756;PU2787,6900PD2787,6756;PU2787,6900
PD2849,6900,2870,6893,2877,6886,2883,6873,2883,6852,2877,6838,2870,6832,2849,682
5,2787,6825;PU2931,6900PD2931,6756,3014,6756;PU3082,6900PD3069,6893,3055,6880,30
48,6866,3041,6845,3041,6811,3048,6790,3055,6777;Ô□□□Ê□□□;PD  3069,
6763,3082,6756,3110,6756,3123,6763,3137,6777,3144,6790,3151,6811,3151,6845,3144,
6866,3137,6880,3123,6893,3110,6900,3082,6900;PU3226,6900PD3226,6756;PU3178,6900P
D3274,6900;PU3315,6852PD3309,6845,3315,6838,3322,6845,3315,6852;PU3315,6770PD330
9,6763,3315,6756,3322,6763,3315,6770;PU3706,6900PD3706,6756;PU3658,6900PD3754,69
00;PU3789,6900PD3789,6756;PU3789,6900PD3850,6900,3871,6893,3878,6886,3885,6873,3
885,6859,3878,6845,3871,6838,3850,6832;Ê□□□Î□□□;PD  3789,
6832;PU3837,6832PD3885,6756;PU3967,6900PD3953,6893,3939,6880,3933,6866,3926,6845
,3926,6811,3933,6790,3939,6777,3953,6763,3967,6756,3994,6756,4008,6763,4022,6777
,4029,6790,4035,6811,4035,6845,4029,6866,4022,6880,4008,6893,3994,6900,3967,6900
;PU4083,6900PD4083,6797,4090,6777,4104,6763,4125,6756,4138,6756,4159,6763,4173,6
777,4179,6797,4179,6900;PU4234,6900PD4234,6756;PU4234,6900PD4296,6900,4317,6893,
4323,6886,4330,6873,4330,6852,4323,6838;Î□□□Î□□□;PD  4317,
6832,4296,6825,4234,6825;PU4378,6900PD4378,6756;PU4378,6900PD4467,6900;PU4378,68
32PD4433,6832;PU4378,6756PD4467,6756;PU4659,6900PD4659,6756,4742,6756;PU4810,690
0PD4755,6756;PU4810,6900PD4865,6756;PU4776,6804PD4845,6804;PU4899,6900PD4899,675
6;PU4995,6900PD4899,6804;PU4934,6838PD4995,6756;PU5043,6900PD5043,6756;PU5043,69
00PD5133,6900;PU5043,6832PD5098,6832;PU5043,6756PD5133,6756;PU5414,6880PD5400,68
93,5379,6900,5352,6900,5331,6893,5318,6880;Î□□□Ó□□□;PD  5318,
6866,5325,6852,5331,6845,5345,6838,5386,6825,5400,6818,5407,6811,5414,6797,5414,
6777,5400,6763,5379,6756,5352,6756,5331,6763,5318,6777;PU5489,6900PD5489,6756;PU
5441,6900PD5537,6900;PU5606,6900PD5592,6893,5578,6880,5571,6866,5565,6845,5565,6
811,5571,6790,5578,6777,5592,6763,5606,6756,5633,6756,5647,6763,5661,6777,5667,6
790,5674,6811,5674,6845,5667,6866,5661,6880,5647,6893,5633,6900,5606,6900;PU5818
,6866PD5811,6880,5798,6893,5784,6900,5757,6900;Ó□□□Î□□□;PD  5743,
6893,5729,6880,5722,6866,5715,6845,5715,6811,5722,6790,5729,6777,5743,6763,5757,
6756,5784,6756,5798,6763,5811,6777,5818,6790;PU5866,6900PD5866,6756;PU5962,6900P
D5866,6804;PU5901,6838PD5962,6756;PU7800,900PD7800,900,7800,879,7800,921,7800,90
0,7200,900,7200,879,7200,921,7200,900,6600,900,6600,879,6600,921,6600,900,6000,9
00,6000,879,6000,921,6000,900,5400,900,5400,879,5400,921,5400,900,4800,900,4800,
879,4800,921,4800,900,4200,900,4200,879;Î□□□Î□□□;PD  4200,
921,4200,900,3600,900,3600,879,3600,921,3600,900,3000,900,3000,879,3000,921,3000
,900,2400,900,2400,879,2400,921,2400,900,1800,900,1800,879,1800,921,1800,900;PU4
800,6096PD4800,6096,4818,6107,4782,6086,4800,6096,5100,5577,5118,5587,5082,5566,
5100,5577,5400,5057,5418,5067,5382,5046,5400,5057,5700,4537,5718,4548,5682,4527,
5700,4537,6000,4018,6018,4028,5982,4007,6000,4018,6300,3498,6318,3509,6282,3488,
6300,3498,6600,2978,6618,2989,6582,2968;Î□□□Ê□□□;PD  6600,
2978,6900,2459,6918,2469,6882,2448,6900,2459,7200,1939,7218,1950,7182,1929,7200,
1939,7500,1420,7518,1430,7482,1409,7500,1420,7800,900,7818,910,7782,889,7800,900
```

```
;PU1800,900PD1800,900,1782,910,1818,889,1800,900,2100,1420,2082,1430,2118,1409,2
100,1420,2400,1939,2382,1950,2418,1929,2400,1939,2700,2459,2682,2469,2718,2448,2
700,2459,3000,2978,2982,2989,3018,2968,3000,2978,3300,3498,3282,3509,3318,3488,3
300,3498,3600,4018,3582,4028,3618,4007;È□□□Ñ□□□;PD  3600,
4018,3900,4537,3882,4548,3918,4527,3900,4537,4200,5057,4182,5067,4218,5046,4200,
5057,4500,5577,4482,5587,4518,5566,4500,5577,4800,6096,4782,6107,4818,6086,4800,
6096;PU1489,1014PD1445,900;PU1489,1014PD1532,900;PU1462,938PD1516,938;PU1559,101
4PD1559,900;PU8032,1014PD8032,900;PU8032,1014PD8075,900;PU8119,1014PD8075,900;PU
8119,1014PD8119,900;PU8222,976PD8222,889,8216,873,8211,867,8200,862,8184,862,817
3,867;PU8222,960PD8211,971,8200,976,8184,976;Ñ□□□Î□□□;PD  8173,
971,8162,960,8157,943,8157,933,8162,916,8173,905,8184,900,8200,900,8211,905,8222
,916;PU4342,6330PD4342,6216;PU4342,6330PD4412,6330;PU4342,6276PD4385,6276;PU4434
,6260PD4499,6260,4499,6270,4494,6281,4488,6287,4477,6292,4461,6292,4450,6287,443
9,6276,4434,6260,4434,6249,4439,6232,4450,6222,4461,6216,4477,6216,4488,6222,449
9,6232;PU4543,6330PD4602,6330,4570,6287,4586,6287,4597,6281,4602,6276,4608,6260,
4608,6249,4602,6232,4591,6222,4575,6216;Î□□□Ò□□□;PD  4559,
6216,4543,6222,4537,6227,4532,6238;PU4814,6314PD4814,6216;PU4765,6265PD4863,6265
;PU5026,6330PD5026,6216;PU5026,6330PD5096,6330;PU5026,6276PD5069,6276;PU5118,626
0PD5183,6260,5183,6270,5178,6281,5172,6287,5161,6292,5145,6292,5134,6287,5123,62
76,5118,6260,5118,6249,5123,6232,5134,6222,5145,6216,5161,6216,5172,6222,5183,62
32;PU5221,6303PD5221,6308,5227,6319,5232,6325,5243,6330,5265,6330,5275,6325,5281
,6319,5286,6308,5286,6298,5281,6287,5270,6270;Ò□□□È□□□;PD  5216,
6216,5292,6216;PU5498,6314PD5498,6216;PU5449,6265PD5547,6265;PU5731,6330PD5731,6
216;PU5693,6330PD5769,6330;PU5791,6330PD5797,6325,5802,6330,5797,6336,5791,6330;
PU5797,6292PD5797,6216;PU;SP 0;SP
6;PU2100,1420PD2192,1475,2284,1530,2375,1585,2467,1640,2559,1695,2651,1750,2742,
1805,2834,1860,2926,1915,3018,1970,3109,2025,3201,2080,3293,2135,3385,2190,3476,
2245,3568,2300,3660,2355,3660,2355,3744,2396,3809,2405,3861,2391,3904,2362,3941,
2323;È□□□Î□□□;PD  3975,
2277,4007,2228,4037,2176,4067,2124,4096,2071,4125,2017,4153,1962,4181,1906,4207,
1848,4233,1789,4259,1729,4285,1671,4314,1617;PU3300,3498PD3330,3446,3360,3394,33
90,3342,3420,3290,3450,3238,3480,3186,3510,3134,3540,3082,3570,3030,3600,2978,36
30,2926,3660,2875,3690,2823,3720,2771,3750,2719,3779,2666,3805,2606,3827,2541,38
46,2469,3861,2391;PU4020,2199PD4099,2247,4178,2295,4256,2344,4335,2392,4414,2440
,4493,2488,4572,2536,4651,2584,4729,2633;Î□□□Ó□□□;PD  4808,
2681;PU3870,2407PD3962,2462,4053,2517,4145,2571,4237,2626,4328,2681,4420,2736,45
12,2791,4603,2846,4695,2901,4787,2955;PU4155,1966PD4220,2004,4284,2043,4348,2081
,4412,2119,4476,2158,4540,2196,4605,2235,4669,2273,4733,2311,4797,2350;PU3000,90
0PD2546,1687;PU3600,900PD2700,2459;PU3000,2978PD3900,1420;PU4800,900PD4800,3706;
PU5400,900PD6600,2978;PU;SP 0;SP
1;PU2197,1379PD2218,1400;PU2176,1400PD2218,1358;PU2176,1358PD2197,1379;PU4800,60
96PD4821,6117;Ó□□□Õ□□□;PU4779,6117PD4821,6075;PU4779,6075PD4800,6096;PU2348,1492
PD2369,1513;PU2327,1513PD2369,1471;PU2327,1471PD2348,1492;PU2349,1432PD2370,1453
;PU2328,1453PD2370,1411;PU2328,1411PD2349,1432;PU2379,1425PD2400,1446;PU2358,144
6PD2400,1404;PU2358,1404PD2379,1425;PU2244,1372PD2265,1393;PU2223,1393PD2265,135
1;PU2223,1351PD2244,1372;PU2442,1540PD2463,1561;PU2421,1561PD2463,1519;PU2421,15
19PD2442,1540;PU2438,1449PD2459,1470;PU2417,1470PD2459,1428;PU2417,1428PD2438,14
49;Õ□□□Ý□□□;PU2306,1411PD2327,1432;PU2285,1432PD2327,1390;PU2285,1390PD2306,1411
;PU2356,1455PD2377,1476;PU2335,1476PD2377,1434;PU2335,1434PD2356,1455;PU2150,131
7PD2171,1338;PU2129,1338PD2171,1296;PU2129,1296PD2150,1317;SP 0;Ý□□□
```

MAPS NOT FILMED

CARTES NON REPRODUITES

micromedia
a division of IHS Canada

20 Victoria Street
Toronto, Ontario M5C 2N8
Tel.: (416) 362-5211
Toll Free: 1-800-387-2689
Fax: (416) 362-6161
Email: info@micromedia.on.ca